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**EFFECTS OF PUBLIC DEBT
ON INCOME DISTRIBUTION**



DOCTORAL DISSERTATION

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PREFACE

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ABBREVIATIONS

BRSA:	Banking Regulation and Supervision Agency
CBRT:	Central Bank of Republic of Turkey
RBC:	Real Business Cycle
SILC:	Survey on Income and Living Conditions
TURKSTAT:	Turkish Statistical Institute



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RÉSUMÉ

La présente étude est conçue pour analyser l'effet des politiques cycliques du secteur public sur la dette publique sur la répartition des revenus dans un pays, en utilisant simultanément des modèles théoriques et des données réelles. Cette étude vise à examiner les liens possibles entre les politiques conjoncturelles en matière de dette publique et ses résultats dans la répartition des revenus à l'aide de modèles théoriques.

L'effet de la dette publique sur la répartition des revenus est analysé dans deux modèles différents. Ces modèles ont des caractéristiques communes. Ils adoptent tous deux l'approche de Pasinetti (1962), qui développa l'idée de Kaldor (1955), concernant les différents taux d'épargne des travailleurs et des capitalistes. Différents taux d'épargne sont définis pour différents ménages. La principale différence entre ces deux modèles théoriques est que le premier limite l'activité du secteur public à l'investissement dans l'infrastructure alors que le second suppose une dépense de consommation publique. Une deuxième différence est que, dans le premier modèle, le secteur public ne peut emprunter que du monde extérieur, alors que dans le second, il ne peut emprunter qu'aux résidents locaux. Les résultats des modèles théoriques indiquent que si le secteur public augmente temporairement ses investissements en infrastructures, cela entraîne une augmentation des salaires des ménages non économes et à faible revenu et améliore la répartition des revenus.

Les théories sur la distribution des revenus s'articulent autour de deux axes principaux: l'approche kaleckienne et l'approche kaldorienne (également appelée approche Cambridge). Les modèles kaleckiens supposent une concurrence oligopolistique et une utilisation des capacités endogènes. Une majoration est ajoutée au prix. Kalecki (1938) se concentre sur la part du travail manuel dans le revenu national, visant à analyser la répartition du produit de l'industrie entre les bénéficiaires, les salaires et les traitements. Kalecki (1938) affirme qu'à long terme, le degré de monopole a tendance à augmenter. Cela signifie que la part des salaires diminue, alors que la part des revenus et des salaires des capitalistes augmente. L'approche kaleckienne de la distribution des revenus est utilisée dans plusieurs études récentes.

Les modèles kaldoriens supposent une concurrence parfaite et une utilisation totale du capital ou un taux d'utilisation du capital fixe à long terme. Kaldor (1955) forme un modèle keynésien sur la distribution des revenus. Les ménages sont regroupés en capitalistes et en travailleurs, avec différentes propensions à épargner et différents types de revenus. La propension à épargner par différents groupes de ménages est une variable importante pour la répartition des revenus et l'économie dans son ensemble. Cette étude adopte l'hypothèse de concurrence parfaite des modèles kaldoriens. Les marchés des biens et du travail sont supposés être

parfaitement compétitifs. Différente du modèle kaldorien, la présente étude suppose une petite économie ouverte.

Lorsque l'on examine les données turques, on constate que, depuis les années 2000, l'encours de la dette et les emprunts nets du secteur public en Turquie ont diminué en termes de ratios avec le PIB. La diminution est observée à la fois dans la dette intérieure et dans la dette extérieure du secteur public. La diminution de la demande d'emprunt du secteur public se traduit par une diminution du coût d'emprunt. La demande de financement du secteur public étant un facteur déterminant du taux d'intérêt réel, le coût de l'emprunt diminuerait pour l'ensemble de l'économie en raison de l'effet d'éviction. Bien que l'encours de la dette du secteur public et les nouveaux emprunts aient diminué dans les années 2000 (à la fois en termes de recettes totales et en termes de PIB), l'investissement en capital fixe du gouvernement a augmenté depuis 2004.

Il est difficile de classer les transferts sociaux par secteur public, car les prestations sociales ont principalement droit à celles du marché du travail formel pendant une longue période. Les transferts sociaux effectués par l'administration centrale, à l'exception des paiements de transfert gérés par l'institution de sécurité sociale, augmentent régulièrement, mais ils représentent une très petite partie des dépenses totales. Alors que la part des transferts sociaux dans les dépenses totales du gouvernement central a augmenté, la part des paiements d'intérêts dans les dépenses totales a diminué. On peut en conclure que réduire le fardeau des paiements d'intérêts sur le budget peut permettre aux politiques gouvernementales d'améliorer la répartition des revenus.

La diminution de la demande d'emprunt du secteur public et la diminution du taux d'intérêt réel se reflètent dans la diminution des revenus financiers des ménages. Les revenus financiers sont concentrés entre les mains des groupes à revenu le plus élevé. Par conséquent, la forte demande d'emprunt et le montant élevé des intérêts payés par le secteur public contribuent à cette concentration. La part décroissante des revenus financiers a entraîné une diminution de la contribution des revenus financiers à l'inégalité des revenus. On peut donc en conclure que la réduction de la demande d'emprunts du secteur public en tant que politique cyclique pourrait améliorer la répartition des revenus.

Le premier modèle théorique de cette étude propose un modèle avec deux types de ménages: l'un de ces types de ménages peut épargner et l'autre pas. À la différence de Kaldor (1955) et de ses extensions, il est supposé que le détenteur de l'actif a un revenu salarial en plus du revenu de l'actif; Ainsi, au lieu de séparer les ménages en capitalistes et en travailleurs, le modèle actuel les divise en épargnants et non-épargnants. Cela est significatif pour mesurer l'effet des dépenses publiques sur les ménages de salariés car les salariés peuvent avoir des opportunités et des habitudes d'épargne très différentes. Au lieu de diviser les ménages en capitaliste, qui gagnent des bénéfices, et les travailleurs, qui gagnent un salaire et des bénéfices. Les séparer en ménages salariés avec des revenus de bénéfices et sans revenus de bénéfices semble plus approprié. De plus, dans ce modèle, les entreprises sont regroupées en entreprises de qualité et de qualité inférieure. L'inclusion de deux types de ménages

et de deux types d'entreprises dans le même modèle vise à mesurer l'effet des dépenses d'investissement de l'État sur différents agents de l'économie.

Les résultats numériques montrent qu'une augmentation des dépenses d'investissement public financées par la dette a des effets hétérogènes sur différents types de ménages et d'entreprises. Il améliore l'inégalité des salaires en augmentant les salaires des ménages main-à-bouche par rapport à ceux des ménages détenteurs d'actifs. En outre, une augmentation des dépenses d'investissement du gouvernement entraîne une augmentation globale du niveau de production. L'analyse de sensibilité du premier modèle indique que les hypothèses de la configuration sont bien construites. Les résultats des étalonnages alternatifs ne sont pas qualitativement différents des résultats de l'étalonnage de référence.

Le deuxième modèle théorique comprend un choc temporaire sur les dépenses publiques et explore les effets sur les principales variables macroéconomiques telles que la consommation, les salaires et les revenus. Les ménages sont regroupés en tant que détenteurs d'avoirs et ménages main-à-bouche; les détenteurs d'actifs sont les détenteurs d'obligations gouvernementales. Les entreprises sont supposées être uniformes; ils ne sont pas groupés. À des fins de simplification, le deuxième modèle théorique extrait du capital physique et introduit des capitaux étrangers à la place. En d'autres termes, le capital étranger est le seul intrant autre que le travail, qui est remboursé avec ses intérêts à la fin de chaque période. Le gouvernement est supposé financer sa consommation et sa dette avec les impôts et la dette intérieure seulement. Dans ce modèle, l'hypothèse selon laquelle les dépenses publiques ne sont utilisées que dans la production est laissée. Les dépenses sont financées par l'épargne des ménages détenteurs d'actifs. De plus, l'investissement étranger est pris en compte. Par conséquent, le compte courant et le compte budgétaire sont séparés les uns des autres. Une dette endogène du gouvernement est ajoutée au modèle et une prime de risque, dépendante de cette dette, est introduite.

Dans ce modèle, les paramètres sont calibrés par rapport aux données turques. Dans un tel environnement, un choc temporaire des dépenses publiques entraîne une inégalité croissante des revenus. Les revenus salariaux des détenteurs d'actifs augmentent, mais cela est lié à l'hypothèse selon laquelle les détenteurs d'actifs travaillent plus longtemps que les ménages main-à-bouche. Les revenus du capital, gagnés par les détenteurs d'actifs, augmentent avec l'augmentation de la dette publique.

La comparaison des seconds moments du modèle avec les données turques révèle que la consommation est fortement corrélée à la production en Turquie, similaire au modèle. La corrélation des salaires horaires avec la production est en revanche très faible, différente du modèle. Les salaires ont également un écart type plus élevé. La dette extérieure est plus fortement corrélée à la production en Turquie, mais reste inférieure à celle du modèle.

L'analyse de sensibilité du deuxième modèle théorique a entraîné des changements quantitatifs dans la plupart des variables. Cela démontre que les hypothèses sont bien définies. Selon l'analyse de sensibilité, une augmentation du

ratio dette publique / production stable, toutes choses étant constantes, réduit la détérioration de l'inégalité des revenus en diminuant la prime de risque sur le taux d'intérêt. Une augmentation du ratio des dépenses publiques à la production en régime permanent détériore davantage la répartition des revenus en raison d'une augmentation substantielle du taux de l'impôt sur les revenus salariaux. Une diminution du ratio des ménages main-à-bouche dans la population totale diminue l'augmentation relative de la dette publique et de la prime de risque d'intérêt, ce qui diminue la détérioration de l'inégalité des revenus.

L'étude a révélé que la dette publique peut réduire l'inégalité des revenus si les sources sont utilisées pour des investissements dans l'infrastructure; mais sinon, l'emprunt public entraîne une inégalité accrue. Ce constat est étayé par les données turques selon lesquelles les revenus financiers sont concentrés entre les mains des groupes à revenu le plus élevé, plus que la concentration du revenu lui-même. L'étude contribue à la littérature en combinant les données micro et macro de la Turquie, en incluant l'importance des dépenses d'investissement du gouvernement et en introduisant un choc des dépenses publiques dans le modèle. Il peut être enrichi en incluant différents types de taxes, une plus grande hétérogénéité des agents, des marchés non parfaitement concurrentiels et des taux d'épargne négatifs.

ABSTRACT

The present study is designed to analyse the effect of cyclical public sector policies regarding public debt on income distribution within a country, using theoretical models and real data simultaneously. This study aims to examine the possible links between the cyclical policies regarding public debt and its results in income distribution with the help of theoretical models.

The effect of public debt on income distribution is analysed in two different models. These models have common features. They both adopt the approach of Pasinetti (1962), who developed the idea of Kaldor (1955), about different saving rates by workers and capitalists. Different saving rates are defined for different households. The main difference between these two theoretical models is that the first one limits the activity of public sector to infrastructural investment whereas the second assumes government consumption spending. A second difference is that in the first model public sector can borrow only from the external world whereas in the second one it can borrow only from domestic residents. The results of the theoretical models indicate that if the public sector increases its infrastructural investment spending temporarily this leads to a rise in wages of non-saving and low-income households and improves income distribution.

There are two main lines of thought in theories on income distribution: the Kaleckian approach and Kaldorian approach (also named as Cambridge approach). Kaleckian models assume oligopolistic competition and endogenous capacity utilization. A mark-up is added to the price. Kalecki (1938) focuses on the share of manual labour in the national income, aiming to analyse the distribution of product of industry between profits, wages and salaries. Kalecki (1938) asserts that in the long run the degree of monopoly has a tendency to increase. This is to say that the share of wages decreases, whereas the share of capitalists' income and salaries rises. Kaleckian approach to the income distribution is used in several recent studies.

The Kaldorian models assume perfect competition and full capital utilization or fixed rate of capital utilization in the long run. Kaldor (1955) forms a Keynesian model on income distribution. The households are grouped into capitalists and workers, with different propensities to save and with different types of income. The propensities to save by different groups of households are important variables for income distribution and economy as a whole. This study adopts the perfect competition assumption of Kaldorian models. The goods and labour markets are assumed to be perfectly competitive. Different from the Kaldorian model, the present study assumes a small open economy.

When Turkish data is examined, it is seen that since 2000s, debt stock and net borrowing of public sector in Turkey decreased in terms of their ratios to GDP. The

decrease is observed both in the domestic debt and in the foreign debt of the public sector. The decrease in borrowing demand by the public sector results in decrease in the cost of borrowing. Since public sector's borrowing demand is an important determinant of real interest rate, the cost of borrowing would decrease for the whole economy due to the crowding out effect. Although the public sector debt stock and new borrowing declined in 2000s (both in total revenues and with respect to GDP), the fixed capital investment by the government increased since 2004.

It is hard to classify the social transfers by public sector, because social benefits are mainly entitled to those in formal labour market for a long period of time. The social transfers by central government, apart from transfer payments managed by Social Security Institution, increase steadily, but they constitute a very small part of total expenditures. While the share of social transfers increased in the total expenditures of central government budget increased, the share of interest payments in total expenditures decreased. It can be concluded that reducing the burden of interest payments on the budget can allow for government policies to improve the income distribution.

The decreasing borrowing demand of public sector and decreasing real interest rate are reflected in the decreasing financial income of households. Financial income is concentrated in the hands of highest income groups. Therefore high borrowing demand and high amounts of interest payment by the public sector contributes to that concentration. Decreasing share of financial income led to decreasing contribution of financial income to the income inequality. Therefore it can be concluded that less borrowing demand by the public sector as a cyclical policy has the potential to improve the income distribution.

The first theoretical model in this study offers a model with two types of households: one of these types of households can save and the other cannot. Different from Kaldor (1955) and its extensions, it is assumed that the asset holder does have a wage income in addition to asset income; so, instead of splitting households as capitalists and workers, the present model splits them as savers and non-savers. This is meaningful to measure the effect of government expenditure on wage-earner households because wage-earners can have very different saving opportunities and habits. Instead of splitting households as capitalist, who earn profit, and workers, who earn wage and profit income; splitting them as households who are wage earners with profit income and without profit income seems more appropriate. Moreover, in this model, firms are grouped as high-quality and low-quality firms. Including two types of households and two types of firms in the same model aims to measure the effect of government investment expenditure on different agents of the economy.

The numerical results show that an increase in debt-financed public investment spending has heterogeneous effects on different types of households and firms. It improves wage inequality by increasing hand-to-mouth households' wages more than that of asset holder households. In addition, an increase in government investment expenditures leads to an overall increase in output level of the economy. The sensitivity analysis of the first model indicates that assumptions of the setup are well-

constructed. The results of alternative calibrations are not qualitatively different from the results of the benchmark calibration.

The second theoretical model includes a temporary shock on public spending and explores its effect on key macroeconomic variables such as consumption, wages and income. The households are grouped as asset holders and hand-to-mouth households; asset holders are the holders of government bonds. Firms are assumed to be uniform; they are not grouped. For simplification purposes, the second model abstracts from physical capital and introduces foreign capital instead. Put differently, the only input other than labour is the foreign capital, which is repaid with its interest at the end of each period. Government is assumed to finance its consumption and debt with taxes and domestic debt, only. In this model, the assumption that government expenditures are only used in production is left. The expenditures are financed from asset-holder households' savings. Additionally, the foreign investment is considered; therefore current account and budgetary account are split from each other. An endogenous debt position of the government is added to the model and a risk premium, dependent on this debt position, is introduced.

In this model, parameters are calibrated with respect to Turkish data. In such an environment, a temporary shock in government expenditures results in increasing income inequality. The wage income of asset holders rises, however this is related to the assumption that asset holders work for more hours than the hand-to-mouth households. The capital income, which is earned by asset holders, rises with increasing public debt.

The comparison of second moments of the model with Turkish data reveals that consumption is highly correlated with output in Turkey, similar to the model. Correlation of hourly wages with output, on the other hand, is very low, different from the model. Wages also have higher standard deviation. Foreign debt has a higher correlation with output in Turkey, but it is still lower, compared to the model.

The sensitivity analysis of the second theoretical model resulted in quantitative changes in most of the variables. This demonstrates that assumptions are well-defined. According to the sensitivity analysis, an increase in the steady-state public debt-to-output ratio, all other things being constant, decreases the deterioration in the income inequality by decreasing the risk premium on interest rate. An increase in steady-state public expenditures-to-output ratio deteriorates income distribution more due to a substantial increase in the rate of tax on wage income. A decrease in the ratio of hand-to-mouth households in the total population decreases the relative increase in the public debt and the interest risk premium, thus decreasing the income inequality deterioration.

The study found that government debt can decrease income inequality if the sources are used for infrastructural investment; but if not, public borrowing leads to higher inequality. This finding is supported by Turkish data that financial income is concentrated in the hands of highest income groups, more than the concentration of income itself. The study contributes to the literature by combining micro- and macro-data of Turkey, by including the importance of government investment expenditure

and by introducing government expenditure shock to the model. It can be enriched further by including different types of taxes, more agent heterogeneity, non-perfectly competitive markets and negative saving rates.



ÖZET

Bu çalışma, bir ülkede kamu borcuna ilişkin döngüsel kamu sektörü politikalarının gelir dağılımı üzerine etkisini teorik modeller ve gerçek verileri aynı anda kullanarak analiz etmek için tasarlanmıştır. Bu çalışma, kamu borcuna ilişkin döngüsel politikalar ile kamu borcunun gelir dağılımı üzerindeki sonuçları arasındaki olası bağlantıları teorik modeller yardımıyla incelemeyi amaçlamaktadır.

Kamu borçlarının gelir dağılımı üzerindeki etkisi iki farklı modelde analiz edilmiştir. Bu modellerin ortak özellikleri bulunmaktadır. Her ikisi de, işçiler ve kapitalistlerin farklı tasarruf oranlarına sahip oldukları yönünde Kaldor (1955) tarafından ortaya atılan ve Pasinetti (1962) tarafından geliştirilen yaklaşımı benimsemektedir. Farklı hanehalkları için farklı tasarruf oranları tanımlanmıştır. İkinci fark ise, ilk modelde kamu sektörünün sadece dış dünyadan borçlanabilmesi, ikincisinde ise sadece yurtiçi yerleşiklerden borçlanabilmesidir. Teorik modellerin sonuçları, kamu sektörünün altyapı yatırım harcamalarını geçici olarak artırması durumunda, tasarruf etmeyen ve düşük gelirli hanehalklarının ücretlerinde artışa yol açacağını ve gelir dağılımını iyileştireceğini göstermektedir.

Gelir dağılımı üzerine teorilerde iki ana düşünce çizgisi vardır: Kaleckiye yaklaşım ve Kaldoryen yaklaşım (Cambridge yaklaşımı olarak da adlandırılır). Kaleckiye modeller oligopolistik rekabet ve endojen kapasite kullanımı varsaymaktadır. Fiyatlara bir kâr yüzdesi eklenir. Kalecki (1938), sanayi üretiminin kâr, ücret ve maaşlar arasındaki dağılımını analiz etmeyi amaçlayarak, el işçiliğinin ulusal gelir içindeki payına odaklanmaktadır. Kalecki (1938), uzun vadede tekel derecesinin artma eğilimine sahip olduğunu ileri sürer. Yani ücretlerin payının azaldığı, kapitalistlerin gelir ve maaşlarının payının arttığı söylenebilir. Kaleckiye gelir dağılımı yaklaşımı yakın zamanda yapılan çalışmalarda da kullanılmaktadır.

Kaldoryen modeller uzun vadede tam rekabet ve tam sermaye kullanımı veya sabit sermaye kullanımı oranı varsaymaktadır. Kaldor (1955) gelir dağılımının Keynesyen bir modelini oluşturmaktadır. Hanehalkları, farklı tasarruf oranlarına ve farklı gelir türlerine sahip olan iki grup olarak kapitalistler ve işçiler olmak üzere gruplandırılmıştır. Farklı hanehalkı gruplarının sahip olduğu farklı tasarruf etme eğilimleri, gelir dağılımı ve bir bütün olarak ekonomi için önemli değişkenlerdir. Bu çalışma Kaldoryen modellerin tam rekabet varsayımını benimsemektedir. Mallar ve işgücü piyasalarında tam rekabet olduğu varsayılmaktadır. Kaldoryen modelinden farklı olarak, bu çalışma küçük açık ekonomi varsaymaktadır.

Türkiye verileri incelendiğinde, 2000'li yıllardan itibaren Türkiye'de kamu kesiminin borç stokunun ve net borçlanmanın GSYİH'ye oranlarında azaldığı görülmektedir. Kamu sektörünün hem iç borunda hem de dış borunda düşüş gözlenmektedir. Kamu sektörünün borçlanma talebindeki düşüş, borçlanma

maliyetinde düşüşe neden olmaktadır. Kamu kesiminin borçlanma talebi reel faiz oranının önemli bir belirleyicisi olduğu için, dışlama etkisi nedeniyle, tüm ekonomi için borçlanma maliyeti azalmıştır. Kamu kesimi borç stoku ve yeni borçlanma 2000'li yıllarda (hem toplam gelirler hem de GSYİH açısından) düşmüş olsa da, 2004'ten beri devletin sabit sermaye yatırımı artmıştır.

Kamu sektörü tarafından yapılan sosyal transferleri sınıflandırmak zordur, çünkü sosyal yardımlara çoğunlukla uzun bir süre kayıtlı işgücü piyasasında kalmış olanlar hak kazanabilmektedir. Sosyal Güvenlik Kurumu tarafından yönetilen transfer ödemeleri dışında merkezi hükümet tarafından yapılan sosyal transferler istikrarlı bir şekilde artmakta, ancak toplam harcamaların çok küçük bir bölümünü oluşturmaktadır. Merkezi yönetim bütçesinin toplam harcamalarında sosyal transferlerin payı artarken, faiz ödemelerinin toplam harcamadaki payı azalmıştır. Buradan, bütçe üzerindeki faiz ödemelerinin yükünün azaltılmasının hükümet politikalarının gelir dağılımını iyileştirmesine izin verdiği sonucuna varılabilir.

Kamu sektörünün azalan borçlanma talebi ve reel faiz oranının düşmesi, hanehalklarının finansal gelirlerinde azalma olarak yansımaktadır. Finansal gelir, en yüksek gelir grubunun elinde yoğunlaşmıştır. Bu nedenle yüksek borçlanma talebi ve kamu sektörünün yüksek faiz ödemeleri söz konusu yoğunlaşmaya katkıda bulunmaktadır. Finansal gelirlerin azalan payı, finansal gelirlerin gelir eşitsizliğine olan katkısını azaltmıştır. Bu nedenle, kamu sektörünün döngüsel bir politika olarak daha az borçlanma talebinin, gelir dağılımını iyileştirme potansiyeline sahip olduğu sonucuna varılabilir.

Bu çalışmanın ilk teorik modelinde iki tür hanehalkı bulunmaktadır: hanehalkı gruplarından biri tasarruf ederken diğeri tasarruf edememektedir. Tasarruf eden hanehalkları varlık sahibi hanehalkları iken, tasarruf edemeyenler kazandığını harcayan hane halkları olarak tanımlanmıştır. Kaldor'dan (1955) ve takipçilerinden farklı olarak, varlık sahibi hane halklarının hem finansal gelire hem de ücret gelirin e sahip olduğu varsayılmaktadır. Böylece model, hanehalklarını kapitalist ve işçi olarak gruplamak yerine, tasarruf edenler ve etmeyenler olarak ayırır. Bu ayırım, devlet harcamalarının ücret geliri olan hanehalkları üzerindeki etkisini ölçmek bakımından anlamlıdır, çünkü ücretliler çok farklı tasarruf fırsatlarına ve alışkanlıklara sahip olabilirler. Haneleri finansal gelir elde eden kapitalistler ve ücret ve finansal gelir kazanan işçiler olarak bölmek yerine, finansal geliri olan ve olmayan hanehalkları olarak bölmek daha uygun görünmektedir. Ayrıca, bu modelde firmalar, yüksek kaliteli ve düşük kaliteli firmalar olarak gruplandırılmaktadır. Aynı modelde iki tür hanehalkı ve iki tür firma tanımlanmasıyla devletin yatırım harcamalarının ekonominin farklı ajanları üzerindeki etkisini ölçmeyi amaçlamaktadır.

Sayısal sonuçlar, borçla finanse edilen kamu yatırım harcamalarındaki artışın, farklı hanehalkı ve firma türleri üzerinde heterojen etkilere sahip olduğunu göstermektedir. Bu tür harcamalar, kazandığını harcayan hanehalklarının ücretlerini, varlık sahibi hanehalkından daha fazla artırarak ücret eşitsizliğini iyileştirir. Ayrıca, devletin yatırım harcamalarındaki artış ekonominin üretim seviyesinde genel bir artışa yol açmaktadır. İlk modelin duyarlılık analizi, modelin varsayımlarının iyi

yapılandırıldığını gösterir. Alternatif kalibrasyonların sonuçları, temel kalibrasyonunun sonuçlarından niteliksel olarak farklı değildir.

İkinci teorik model, kamu harcamalarında geçici bir şok içermektedir ve bu şokun tüketim, ücretler ve gelir gibi temel makroekonomik değişkenler üzerindeki etkisini incelemektedir. Hanehalkları varlık sahipleri ve kazandığını harcayan hanehalkları olarak gruplandırılmıştır; varlık sahipleri devlet tahvili sahipleridir. Firmaların tek tip olduğu varsayılmaktadır; gruplandırılmamışlardır. Basitleştirme amacıyla ikinci model, fiziki sermaye kapsamaz, bunun yerine yabancı sermaye olduğunu varsaymaktadır. Diğer bir ifadeyle, emeğin dışındaki tek girdi, her dönemin sonunda faiziyle birlikte geri ödenen yabancı sermayedir. Devletin tüketimini ve borcunu sadece vergi ve iç borç ile finanse ettiği varsayılmaktadır. Bu modelde, devletin harcamalarının sadece üretimde kullanıldığı varsayımı terk edilmiştir. Harcamalar, varlık sahibi hanehalklarının tasarruflarından finanse edilmektedir. Ayrıca, yabancı yatırım dikkate alınır; bu nedenle cari hesap ve bütçe hesabı birbirinden ayrılır. Hükümetin iç borç pozisyonu modele eklenmiş ve bu borç pozisyonuna bağlı olan bir risk primi modele eklenmiştir.

Bu modelde, parametreler Türkiye verilerine göre kalibre edilmiştir. Bu şartlar altında, devlet harcamalarındaki geçici bir şok, gelir eşitsizliğinin artmasına neden olmaktadır. Varlık sahiplerinin ücret gelirleri artmaktadır, ancak bu durum, varlık sahibi olan hanehalklarının kazandığını harcayan hanehalklarından daha fazla saat çalıştığı varsayımıyla ilgilidir. Varlık sahipleri tarafından kazanılan finansal gelir, artan kamu borcuyla birlikte yükselmektedir.

Model değişkenlerinin ikinci momentlerinin Türkiye verileri ile karşılaştırılması, Türkiye’de tüketim ile üretimin modele benzer olarak yüksek oranda ilişkili olduğunu ortaya koymaktadır. Öte yandan, üretim ile saatlik ücretlerin korelasyonu Türkiye’de, modelden farklı olarak, çok düşüktür. Ücretler de daha yüksek standart sapmaya sahiptir. Dış borç, Türkiye’de üretim ile daha yüksek bir korelasyona sahiptir, ancak modele kıyasla yine de düşüktür.

İkinci teorik modelin duyarlılık analizi, değişkenlerin çoğunda sadece niceliksel değişimlere yol açmıştır. Bu, varsayımların iyi tanımlandığını göstermektedir. Duyarlılık analizine göre, denge durumunda devlet borcunun üretime oranındaki bir artış, diğer her şey sabit kalırken, faiz oranındaki risk primini azaltarak gelir eşitsizliğindeki bozulmayı azaltmaktadır. Devlete ait kamu harcamalarının üretime oranının denge noktasındaki büyüklüğündeki bir artış, ücret gelirindeki vergi oranındaki önemli artış nedeniyle, gelir dağılımını daha da kötüleştirmektedir. Kazandığını harcayan hanehalklarının toplam nüfus içindeki oranındaki bir azalma, kamu borcundaki göreceli artışı ve faiz riski primini azaltarak gelir eşitsizliğinin bozulmasını azaltmaktadır.

Bu araştırma, kaynakların altyapı yatırımları için kullanılması halinde devlet borcunun gelir eşitsizliğini azaltabileceğini bulmuştur; Ancak diğer durumlarda, kamu borçlanması daha yüksek eşitsizliğe yol açar. Bu bulgu, Türkiye verisi kullanılarak yapılan analizlerde, finansal gelirlerin en yüksek gelir grubunun elinde, toplam gelirdeki yoğunluktan da daha fazla yoğunlaştığı bulgusuyla

desteklenmektedir. Bu çalışma, devletin yatırım harcamalarının önemini ve devlet harcaması şokunu modele dahil ederek, Türkiye'nin mikro ve makro verilerini birleştirerek literatüre katkıda bulunmaktadır. Farklı vergiler, daha fazla ajan heterojenliği, tam rekabetçi olmayan pazarlar ve negatif tasarruf oranları dahil edilerek bu çalışma ileride daha da zenginleştirilebilir.



1. INTRODUCTION

The present study is designed to analyse the effect of cyclical public sector policies regarding public debt on income distribution within a country, using theoretical models and real data simultaneously.

Data on Turkish economy suggest some links between the public debt burden and income distribution inequality in Turkey. Decreasing domestic public debt stock and domestic public debt interest payments occur simultaneously with decreasing share of financial income in total income and decreasing role in income inequality. This study aims to examine the possible links between the cyclical policies regarding public debt and its results in income distribution with the help of theoretical models.

The effect of public debt on income distribution is analysed in two different models. The main difference between these two theoretical models is that the first one limits the activity of public sector to infrastructural investment whereas the second assumes government consumption spending. A second difference is that in the first model public sector can borrow only from the external world whereas in the second one it can borrow only from domestic residents. In relation with this aspect, the first model does not include an explicit public sector debt variable because it is equal to the public budget deficit. This assumption is discarded in the second model, where public debt is an explicit variable and a country risk premium related to public debt is included in real interest rate. A third difference is that one of the models includes two types of firms whereas the other assumes only one type of firms.

These models have common features. They both adopt the approach of Pasinetti (1962), who developed the idea of Kaldor (1955), about different savings rates by workers and capitalists. Different saving rates are defined for different

households; actually, one type of households does not save. The Kaldorian models assumed one type of households having wage and financial income, whereas the other has only financial income. In the present study, one type of the households is assumed to gain only wage income, whereas the other one is assumed to gain both of them. The non-saving households are assumed to be low-income households. This is appropriate for Turkish economy, as the data shows that households with low-income have lower levels of financial income.

Both of the theoretical models represented here are dynamic. The majority of theories on income distribution include static models. The models presented here fall in the category of dynamic stochastic general equilibrium models. Different from the existing literature, the models used in this study assume a temporary shock on government expenditures. The macro-data and micro-data are used together, to calibrate the theoretical models appropriately and to create the necessary links for the Turkish economy.

The results of the theoretical models indicate that if the public sector increases its infrastructural investment spending temporarily this leads to a rise in wages of non-saving and low-income households and improves income distribution. If the government borrow from domestic residents and finance its non-investment spending using this debt, the financial income obtained by saving households increases and the income distribution worsens.

Chapter 2 presents a brief summary of theories related to income distribution. Two main schools of thought, namely the Kaldorian and Kaleckian schools are represented. The original models of both schools are explained and some of the recent contributions to the theories are referred. Public sector, especially public debt, is not included in the original models. The contributions including public debt are given priority in this dissertation. Studies out of the two traditions but including public and income distribution issues simultaneously are also summarized briefly.

In Chapter 3, the indicators of public policy in 2000s are considered. Taxes, social transfers, public investment, debt position, net borrowing and interest payments of public sector since 2000s are analysed. Then, the related parts of micro-data from Survey of Income and Living Conditions collected by TURKSTAT are analysed in detail. The links between the macro- and micro-data are constructed in this chapter. It is found that, government debt payments and interest rates decreased in 2000s and this was parallel to a decrease in the role of financial income in household income distribution. The contribution of financial income to household income inequality reduced in the mentioned period.

Chapter 4 represents the first theoretical model. There are savers and non-savers, working in two different types of firms. One of these types of firms relies on government infrastructure and hires non-savers. The dynamic open economy model is calibrated flexibly and sensitivity analysis is done with different calibrations. The results indicate that a one-time cyclical government investment expenditure shock improves the wage inequality.

The model is carried forward in Chapter 5, where the types of households are preserved but the firms are assumed to be uniform. Government does not invest and the capital is non-stock foreign capital. The calibration is done with respect to Turkish data since 2000s. Alternative calibrations are applied. The results indicate that the temporary shock in government spending, leading to an increase in the level of public debt, worsened income inequality in such an environment. The result is in line with the findings from Turkish data in Chapter 3 that public debt leads to an increase in financial income and increasing financial income worsens the income inequality.

Chapter 6 concludes, with suggestions for possible future studies.

2. THEORIES ON INCOME DISTRIBUTION

2.1. Introduction

There are two main lines of thought in theories on income distribution: the Kaleckian approach and Kaldorian approach (also named as Cambridge approach). Kaleckian approach is based on the studies of Kalecki(1938, 1954). Kaldorian approach is based on the seminal paper of Kaldor (1955) and developed by Pasinetti (1962, 1989).

The Kaldorian models assume perfect competition and full capital utilization or fixed rate of capital utilization in the long run. Kaldorian models equate the growth rate to the capital accumulation rate and define the growth of macroeconomic variables with respect to that rate. Growth affects the aggregate demand. In these models, the output is divided into wage share and profit share. The households are grouped into capitalists and workers, with different propensities to save and with different types of income. The propensities to save by different groups of households are important variables for income distribution and economy as a whole. The different groups of income do not only represent different propensities to save, but also different levels of ownership of assets.

Government sector is introduced in models following the Kaldorian tradition. In these model, the government spending is assumed to increase the profit share and support the aggregate demand, hence growth.

Kaleckian models, on the other hand, assume oligopolistic competition and endogenous capacity utilization. A mark-up is added to the price. The mark-up rate is determined by the level of monopoly in the market and the bargaining power of firms

and labour unions in labour market. Kaleckian models include labour market imperfections and class struggle. Thus, respective bargaining power of firms and workers in the labour market affect the mark-up rate, hence the income distribution. In the original model, saving propensities are not defined as variables. In recent Kaleckian models, the savings by different groups of income are included as in Kaldorian models.

There are studies on income distribution which include some aspects from either or both of these two schools of thought. This chapter gives a brief summary of these theories. Section 2.2 summarizes the seminal paper of Kalecki and mentions some recent contributions to this theory. Section 2.3 analyses the Kaldorian school of thought. Section 2.4 mentions some studies which cannot be classified within these groups but focus on the income distribution with respect to the public debt. Section 2.5 concludes.

2.2. Kaleckian Framework of Income Distribution

Kalecki (1938) focuses on the share of manual labour in the national income, aiming to analyse the distribution of product of industry between profits, wages and salaries. Salaries are the payments to directors, managers etc. in the industry and they are included in profits. Payments to the manual labour, on the other hand, are named as wages. The author constructs a model to examine the distribution of income in such an economy. The degree of monopoly in the industry is an important variable in this model.

According to the model, the short-term marginal cost, m , is:

$$m = d_m + s_m + w_m + r_m$$

where d_m , s_m , w_m , and r_m are the short-term marginal costs of depreciation, salaries, wages and raw materials, respectively. Price, p , on the other hand, is:

$$p = c_a + d_a + s_a + w_a + r_a$$

where c_a is the average capitalist income and d_a , s_a , w_a , and r_a are average costs of depreciation, salaries, wages and raw materials, respectively. The difference between price and marginal cost of one unit of good is thus:

$$p - m = c_a + (d_a - d_m) + (s_a - s_m) + (w_a - w_m) + (r_a - r_m) \quad (2.1)$$

and the degree of monopoly, μ , is calculated by the following equation:

$$\mu = \frac{p - m}{p} \quad (2.2)$$

When Eq. (2.2) is substituted in the Eq. (2.1), multiplied by the amount of output, x , and aggregated for the whole industry, the following equation is obtained:

$$\sum xp\mu = \sum xc_a + \sum x(d_a - d_m) + \sum x(s_a - s_m) + \sum x(w_a - w_m) + \sum x(r_a - r_m) \quad (2.3)$$

The author simplifies Eq. (2.3) according to the following assumptions:

- Marginal depreciation is smaller than average depreciation. Therefore $\sum x(d_a - d_m)$ can be simplified as $D(1-\alpha)$, where α is a small positive fraction and D is the aggregate depreciation. The same is valid for $\sum x(s_a - s_m)$, which is simplified as $S(1-\beta)$, S being the aggregate salary.
- $\sum x(w_a - w_m)$ can be positive or negative with respect to aggregate wages W , related to the average wage-cost curve of the related industry. The author simplifies $\sum x(w_a - w_m)$ to γW , where γ is a small positive or negative fraction.
- Average cost of raw materials is assumed to be constant. Hence $\sum x(r_a - r_m)$ is replaced by 0.
- $D\alpha + S\beta - \gamma W$ is assumed to be 0.

When these assumptions are applied, Eq. (2.3) simplifies to:

$$\sum xp\mu = C + D + S \quad (2.4)$$

and when both sides are divided by aggregate turnover, $T = \sum xp$, left-hand side of the equation gives the average of degree of monopoly power (μ):

$$(\mu) = \frac{C + D + S}{T} \quad (2.5)$$

The shares of C , D , and S to the national income can be simply found by multiplying two sides of Eq. (2.5) with ratio of turnover to gross income, T/Y , as follows:

$$(\mu) \frac{T}{Y} = \frac{C + D + S}{Y} \quad (2.6)$$

Kalecki (1938) claims that the relative shares of capitalists' income, salaries and depreciation in total income are dependent on the average degree of monopoly and the turnover ratio. The share of wages in national income can be driven from Eq. (2.6) as:

$$\frac{W}{Y} = \frac{Y - (C + D + S)}{Y} \quad (2.7)$$

Then, the relationship between mark-up rate and turnover ratio is given by:

$$\frac{W}{Y} = 1 - (\mu) \frac{T}{Y} \quad (2.8)$$

The share of wages in national income is negatively related with the degree of monopoly and the turnover ratio (Eq. (2.8)). The degree of monopoly and the turnover ratio are not independent, they are negatively related. Kalecki (1938) asserts that in the long run the degree of monopoly has a tendency to increase. This is to say that the share of wages decreases, whereas the share of capitalists' income and salaries rises. This claim is verified by the data of Great Britain economy, covering 1880-1913 (Kalecki, 1938).

Kaleckian approach to the income distribution is used in several recent studies. Hein (2007) introduced debt variable to the existing model. According to the model by Hein (2007), the price is determined with respect to mark-up rate (m), wage rate (w) and a labour-output ratio (l), which is constant up to full capacity. Therefore, the price, p , is given by the following equation:

$$p = (1 + m)wl$$

and the total revenue is:

$$pY = (1 + m)wL$$

where L is the amount of labour employed. Therefore, profits, Π , and labour income in total production are given by mwL and wL , respectively. The profit share h is given by:

$$h = \frac{mwL}{pY} = 1 - \frac{1}{1 + m}$$

As the model assumes that the capacity utilization rate < 1 , then a capital-potential output ratio, v , is defined, rather than capital-output ratio. The rate of capital utilization is u , which is equal to the ratio of real output, Y , to potential output, Y^v . The rate of profits, r , is thus given by:

$$r = \frac{mwL}{pK} = \frac{mwL}{pY} \frac{Y}{Y^v} \frac{Y^v}{K} = hu \frac{1}{v}$$

Thus the rate of profits depends on the rate of capacity utilization. As mentioned above, Hein (2007) introduced debt to the model. Debt is given by some rentiers to the firms as credits. Hence the profits are split into the profit of the enterprise, Π^n , and the interest income of rentiers, Z ; and debt-capital ratio, λ , is introduced to the model:

$$\Pi = \Pi^n + Z = \Pi^n + iB$$

$$\lambda = \frac{B}{pK}$$

where i denotes the interest rate and B denotes the stock of credit. The author suggests that the profit given to the firm will be saved totally, whereas the profit given to the rentiers will be saved in a ratio equal to the saving propensity of rentiers, which is denoted by s_z . Therefore, a higher interest rate under constant r , λ and s_z , would decrease savings. An increase in λ would also lead to a decrease in savings.

Hein (2018) includes a government sector and government debt in Kaleckian framework. In this model, all profits are distributed to rentiers. Rentiers also hold the government debt, and they earn financial income on this debt. Therefore share of wages in total income is negatively correlated with share of profit in income and

ratio of financial income to total income. Share of profit, on the other hand, is negatively related with the ratio of financial income to total income.

Ünveren and Sunal (2015) analyse the reason of low labour share in total production in Turkey and find that the labour share is low due to the high concentration rates and high price mark-ups. The study assumes a real business cycle economy with monopolistic competition. According to the results of Generalized Method of Moments (GMM) analysis performed with data of Turkish economy, the gap between the labour share in Turkey (around 30%) and OECD (65% in average) occur due to the mark-up rates. This result is in line with the above-mentioned Kaleckian perspective.

2.3. The Cambridge Theory of Income Distribution

The Cambridge theory of income distribution (name given by Samuelson and Modigliani, 1966) is first described by Kaldor (1955). Kaldor (1955) forms a Keynesian model on income distribution. According to the theory, the society is divided into capitalists and workers, who save some part of their incomes. The propensity to save out of profit is assumed to be higher than the propensity to save out of wage income. National income, on the other hand, is also divided in two categories: profits and wages. Different from the Kaleckian model, the wages include salaries, paid to managers etc. (in Kaleckian model, salaries and managerial pay are not included in wages, considered as a part of profits).

If the saving propensity out of profits is s_p and saving propensity out of wage income is s_w then the following equations hold:

$$Y = W + P$$

$$I = S$$

$$S = S_w + S_p$$

where W denotes the total wages, P denotes the total profits, I denotes investment, S denotes total savings, S_w denotes savings out of wage income and S_p denotes savings out of profit.

The shares of profit and wage in income are given by the following equations:

$$\frac{P}{Y} = \frac{1}{s_p - s_w} \frac{I}{Y} - \frac{s_w}{s_p - s_w} \quad (2.9)$$

$$\frac{W}{Y} = \frac{1}{s_w - s_p} \frac{I}{Y} - \frac{s_p}{s_w - s_p}$$

If workers do not save and $s_w=0$, then, Eq. (2.9) becomes:

$$P = \frac{1}{s_p} I$$

According to the equations, distribution of income between wages and profits are dependent on the saving propensities out of wages as well as of profits and on the ratio of investment to output. If the values of s_p and s_w are closer, a small change in investment-to-output ratio leads to a larger change in the income distribution. If $s_p = s_w$, the shares of wages and profits become zero. If $s_p < s_w$, the system becomes unstable.

Pasinetti (1962) aims to continue the effort to connect the income distribution to the rate of economic growth. The author argues that the society can be grouped as "capitalists" and "workers", with different propensities to save, as in Kaldor (1955). However, Pasinetti (1962) underlines that Kaldor (1955) does not specify where the savings of workers are used. Therefore, Pasinetti (1962) defines that savings by workers are used in production and yields interest income, as the savings of capitalists do. When profit income is assumed to be shared between workers and capitalists, the definitions by Kaldor (1955) implying the propensities to save out of wages and profits become invalid. Workers can save out of both wages and profits. Therefore, the propensities to save should be defined as workers' propensity to save, s_w ; and capitalists' propensity to save, s_c .

Pasinetti (1962) replaces the variable s_p in Kaldor (1955) with s_c and adds more limitations to the values of s_w and s_c such that:

$$s_w < \frac{I}{Y}$$

to ensure that profit share is positive, and

$$s_c > \frac{I}{Y}$$

to ensure that wage share is positive.

As workers use their savings to gain profit, the following equations hold:

$$Y = P_c + P_w + W$$

$$S = s_w(W + P_w) + s_c P_c$$

$$S = I$$

where P_w is the profit accrued to workers and P_c is the profit accrued to capitalists.

The profit share of capitalists thus becomes:

$$\frac{P_c}{Y} = \frac{1}{s_c - s_w} \frac{I}{Y} - \frac{s_w}{s_c - s_w}$$

In this model, the economy grows and the steady-state rate of return to capital is dependent on the rate of growth and the propensity of capitalists to save. The steady-state level of capital-to-output ratio and share of capital income to total income is also dependent on capitalists' propensity to save. Workers' propensity to save does not have any effect on income distribution.

Samuelson and Modigliani (1966) criticizes the above-mentioned model of Pasinetti (1962) and name it as "Pasinetti Paradox". According to the authors, the finding by Pasinetti (1962) that saving propensity of workers do not have any impact on capital-to-output ratio and share of capital in total output is valid only under very limited conditions and can be reversed under other conditions. The "dual theorem" defined by Samuelson and Modigliani (1966) is that when the workers' propensity to save exceeds a critical level, the rate of interest, capital-to-labour and capital-to-output ratio and distribution of income become only dependent on workers' saving propensity and the rate of growth.

Steedman (1972) contributes to the model of Pasinetti (1962) by including government activity to the model and claims that inclusion of government taxing and spending does not cause a qualitative change in Pasinetti's model. In the closed economy framework of Steedman (1972), workers receive transfer payments from government, in addition to wage income and profit. Government collect taxes to finance transfer payments. The budget is assumed to be balanced. The total stock of capital, K , consists of capital belonging to workers, K_w , and capital belonging to capitalist, K_C . Savings by workers and capitalists increases the capital share of respective group. Therefore, the following equations hold:

$$\frac{d}{d_t} K_w = s_w [(1 - t_1)W + (1 - t_2)rK_w + kG]$$

$$\frac{d}{d_t} K_C = s_c (1 - t_2)rK_C$$

The parameter r is the rate of profit, t_1 is the rate of tax on wage income and t_2 is the rate of tax on profit income, G is the government spending, and k is the share of transfer payments in government spending. In the long-run, it is assumed that the growth rate of capital is equal to the growth rate, n , and it is the same for capitalists' and workers' share. So, the rate of profit becomes:

$$r = n / (1 - t_2) s_c \quad (2.10)$$

The net rate of profit, n/s_c , obtained by multiplying Eq. (2.10) by $(1 - t_2)$ is independent of any tax rate. Disposable income of workers, on the other hand, negatively related with t_1 and t_2 .

Pasinetti (1989) introduces government expenditure and taxation to the former model. In this model, a government propensity to save, s_T is introduced and government expenditure is given as:

$$G = (1 - s_T)T$$

where s_T can be positive or negative. This model differs from Steedman (1972) model where there is no possibility of public surplus or debt. Government applies both direct taxes (on wage income, profit income) and indirect taxes (on

consumption expenditures of capitalists, workers and government itself). If $s_T = 0$, the government budget is balanced. However, as two different taxes are defined on wage income and profit income, Pasinetti (1989) introduces two different propensities to save by workers. One is workers' propensity to save out of wages and the other is workers' propensity to save out of profits. In the Cambridge equation, the profit rate, r , is only dependent upon the growth rate, g_n , and saving propensity to capitalists does not change. Although the gross profit rate depends on the tax rate on profit income:

$$r = \frac{1}{s_c(1-t_p)} g_n$$

the net profit rate does not depend on the tax rate, as in Steedman (1972):

$$r(1-t_p)(1/s_c)g_n$$

In the case of government debt or surplus, the savings propensities and final saving amounts of capitalists and workers change, but the rate of profit are not affected by the government policy. As in the model without government, workers' saving propensity does not affect the equilibrium level of share of profits. On the other hand, the share of wages is affected by taxation.

As the model constructed by Pasinetti (1989) is a closed economy model, the public debt can only be domestic debt. When public sector borrow, the households know that there is a future liability of taxation for them and they put aside some of their savings. This reduces capital stock in the economy. Therefore, Ricardian Equivalence Theorem holds: borrowing and imposition of taxes have the same effects. It holds because in Kaldorian distribution models, saving is dependent upon constant propensities to save and it is not likely that households are able to smooth their consumption over time to meet tax requirements, as asserted by Neutrality Theorem (Barro, 1974).

Pasinetti (1989) argues that if bonds are issued by the government and households who save buy public bonds and private loans, rate of interest on these two different types of assets would be the same. Government sector would collect the

same amount of money when it issues bonds and when it impose the taxes, because households would do extra saving in exactly the same amount of their future tax liability. Even if there is positive interest rate nothing changes, as the government would collect the tax to pay its debt together with the interest from households, and pay its debt to the households together with the interest.

2.4. Public Debt and Income Distribution

The models summarized in previous chapters focus mainly on the income distribution. Some of them include the public sector and public debt. In this section, some models that focus on the relationship between public debt and income distribution are presented.

Modigliani (1961) assumes that the expansionary fiscal policy has a positive impact on consumption by households. The mechanism is simply summarized as follows: an increase in government debt to finance government expenditure, rather than an increase in taxes, leads to an increase in perceived wealth of households and triggers consumption. This results in a reduction in savings, an increase in interest rates and thus, a decrease in capital accumulation. However, future taxes which will probably be applied to finance the government debt interest payments will reverse the wealth effect, to a certain degree (Barro, 1974). Barro (1974) argued that in an overlapping generations framework, the mechanism claimed by Modigliani will not work, because current generations will act as they are living infinitely.

Mankiw (2000) designed a model, including saver and spender households, and claimed that government debt does not alter the steady state value of capital stock or output, but influence steady state income distribution, simply because government debt is financed by extra taxes on spenders and savers, whereas interest rate on government debt is only paid to savers. Therefore income inequality worsens. Impact of government debt on inequality can be examined by a kind of welfare measure.

Some models include wealth and consumption out of wealth. This enhances the explanatory power of the literature because people can consume from their wealth in order to smooth their consumption. If workers and capitalist save, following Pasinetti (1989), they can also consume from their corresponding wealth (Palley, 2012). Workers' propensity to consume from their wealth is assumed to be lower than capitalists' propensity to consume their wealth, as the case in propensity to consume out of income. In the model assumed by Palley (2012), propensity to consume out of wealth is lower than the propensity to consume out of income, for both workers and capitalists.

Wealth position of households can be defined with respect to their holdings of government debt and therefore, the impact of government debt on distribution can be monitored more closely. In D'Erasmus and Mendoza (2016), two groups of households are defined; both groups of households hold government debt, but they hold in different amounts: one group has less bonds in the initial state.

In general equilibrium models which include government behaviour, taxes on labour and capital income, government debt and interest payments and consumption and transfer payments of government, or a combination of these, are considered (e.g. (Flodén, 2001)). Government can finance its expenditures by increasing taxes, issuing money or collecting debt from financial markets. In order to collect debt, government pays an interest rate. Government can collect debt from domestic households, who does saving (rentiers' class in Hein (2018)), from private sector or from abroad (Diamond, 1965).

Yakut and Voyvoda (2017) construct a computable general equilibrium model, in order to assess the impact of public policies on distribution. Seven groups of representative households are defined according to their source of income. The groups are collected in two subsets: Ramsey-type households who do saving and maximize their life-time utility and non-saving households who maximize their present time utility. Ramsey-type individuals make the intratemporal choice between consumption and leisure. Firms, on the other hand, consist of 11 representative firms,

each one operating in a different sector. Government sector collects tax, makes transfer payments to households and firms, and covers social security deficits, in addition to the public expenditures. The authors include internal migration in Turkey as an important factor on wages, savings, consumption levels and distribution. The results of the study show that transfers to households leads to a decrease in labour supply, whereas government policies reduce the cost of labour increases in labour supply.

2.5. Conclusion

The theories of income distribution can be grouped under the headings of Kaldorian and Kaleckian schools. The two groups of theories are both developing and there are transitions from one to the other.

The present study makes use of existing studies, adapting their specifications to the needs of the particular aim. For example, the study benefits from Kaldor (1955) and its extensions in grouping the households with respect to their saving habits. Different from the existing models, the present study assumes that the asset holder does have a wage income in addition to asset income, whereas the workers earn wage income. Instead of splitting households as capitalists and workers, the present model splits them as savers and non-savers. The constant propensities to save by different groups of households are not adopted in the present study. One of the groups of households does not save, whereas the other's saving is determined by the intertemporal utility function. This study adopts the perfect competition assumption of Kaldorian models. The goods and labour markets are assumed to be perfectly competitive. Different from the Kaldorian model, the present study assumes a small open economy.

Different from the above-mentioned models of general equilibrium, the present study includes two models with a temporary shock on public spending and explores its effect on key macroeconomic variables such as consumption, wages and income. In addition to these contributions, the present study adopts a micro-founded setup.

This aspect is important because micro-founded general equilibrium models generally neglect the distributive effects of fiscal policy. Thus, the present study contributes both to the discussion of income distribution by carrying it out in a new framework and to micro-founded general equilibrium models by introducing distributive fiscal policy and by distinguishing various public spending types such as infrastructure or public consumption, an aspect which does not exist in Kaldorian or Kaleckian models.



3. PUBLIC DEBT AND INCOME INEQUALITY IN TURKEY

3.1. Introduction

Income inequality has a tendency to rise in recent years. Alvaredo et al. (2017) claim that income inequality increased in North America, Asia and Europe and became stabilized in Middle East, albeit in high levels, since 1980. According to the Gini coefficient values calculated by Hein (2015), Gini coefficients in 15 most developed countries, based on before-tax income, increased in the first ten years of 2000s except for Netherlands. Income inequality can be attributed to several reasons, including political preferences of policy makers, the side effects of economic policies and business cycles as well as structural changes such as financial developments, technological progress or bargaining power of trade unions.

Income inequality in Turkey measured by Gini coefficient decreased in recent years according to Sefil-Tansever (2017). The calculations of income inequality in Turkey are based on Survey on Income and Living Conditions (SILC) data gathered by Turkish Statistical Institute (TURKSTAT, 2018b). According to inequality decomposition used by Sefil-Tansever (2017), inequality in income distribution mainly comes from labour and entrepreneurship earnings for the period between 2006 and 2014 (SILC data started to be collected in 2006). The weight of labour earnings in income inequality increased since 2006, while the weight of entrepreneurship declined.

Government policies can positively or negatively affect the income distribution even when these policies do not aim at income inequality. The role of public sector in economy has distributive impact, whereas taxation policy and transfer expenditures to the society lead to redistributive impacts. However, the relationship between public debt and income inequality is analysed in a very limited number of

sources. Public debt can affect the income distribution of a country according to its two main aspects: from whom the money is borrowed and what the money is used for.

Salti (2015) uses a cross-country panel data about the lender to public sector to design an econometric analysis about the determinants of inequality and the role of public debt and debt composition. The results indicate two important findings: first, the level of public debt was significantly and positively related with income inequality and second, the share of domestically-held debt in total public debt was significantly and positively related with income inequality. The composition of public debt is one of the factors to be dealt with in the present chapter.

The present chapter aims at illustrating the trends of Turkish economy in 2000s, regarding the budget balance and public borrowing. Then, the signs of relationship between these two groups of indicators are interpreted. There are two channels through which public borrowing is expected to affect the income distribution: through the interest payments for domestic public debt and via social transfers. Data used for analysis in this study is obtained from two main sources: One is the budget and financing data from Undersecretariat of Treasury of Turkish government and the other is the data of Survey of Income and Living Conditions, conducted by TURKSTAT. In addition, the data on ownership of bank deposits from BRSA (Banking Regulation and Supervision Agency) and data on fixed capital formation from Ministry of Development is used.

Başlevent (2014), who also uses SILC data, underlines that evaluation of the redistributive impact of social transfers on income inequality in Turkey is difficult, mainly due to the lack of detailed data. Başlevent argues that the data is limited to evaluate the effect of social transfers on income inequality because some payments to individuals and households are lumped together. This is one of the problems confronted during this study, too; and will be explained in detail.

The remaining part of this chapter is organized as follows: In Section 3.2, data on Turkish public sector after 2000s is analysed under two headings: tax collecting, social transfer payments and investment by public sector are analysed in Subsection 3.2.1 whereas the magnitude of revenues and expenditures, the debt position and interest payment position of public sector are examined in Subsection 3.2.2. In Section 3.3 income distribution in Turkey is demonstrated by means of a detailed examination of SILC data. The focus is on the effect of different types of income on income inequality. The role of public sector on this effect is discussed. Section 3.4 concludes.

3.2. Public Sector in Turkey

Cyclical policies of public sector can affect the income distribution in different ways. The aim of the present chapter is to reveal some hints on the relationship between the cyclical public sector policies and income distribution. Therefore, an analysis of tax collection, social transfer and investment activities and debt position of the public sector is given in the following subsections.

3.2.1. Public Sector Activities

The Central Government Budget Balance and Financing Data of Turkey announced by Undersecretariat of Treasury demonstrates the central government budget revenues, central government budget expenditures and budget financing of Turkish government for the years between 2006 and 2017, on a monthly and annual basis (Undersecretariat of Treasury, 2018). Data is also available for general government budget; but central government budget data is more extensive than general budget government, because general budget data includes "public administrations within the scope of general budget", according to the Public Financial Management and Control Law No. 5018, where central government budget covers special budget administrations and regulatory and supervisory agencies in addition to the institutions within the scope of general budget. Both budgets exclude social security institutions.

Data is also available for the period between 1994 and 2005, under the heading of "Consolidated Budget Balance and Financing". This data covers general and annexed budget administration. The data for this period is less detailed than the data released after 2006. It includes amount of total revenues and total expenditures, interest payments (both domestic and foreign), net borrowing (both domestic and foreign), taxes within total revenues (both direct and indirect), but does not include the sub-items of expenditures. The budget data released after 2006 includes social transfers and transfers to households, which is meaningful for the purposes of this study; but for the years before 2005, data does not include these details.

The data about public budget and finance released by Undersecretariat of Treasury (2018) is given in million TL units. Due to inflation concerns, the amounts will not be used as numerical quantities. Every quantity will be expressed as a ratio to some other quantities (i.e. total revenues, total expenditures, or GDP) in order to avoid misleading results.

When the sub-items of revenues are analysed, it is seen that the revenues are grouped as tax revenues, other budget revenues, revenues of special budget industries and revenues of regulatory and supervisory institutions. For the purposes of this study, the rate of tax revenues to the central budget revenues on annual basis are composed and given in the following Table 3.1. As seen in the table, the share of tax revenues within the central government budget revenues increased almost continuously during the given period (2000-2017).

Treasury data includes budget expenditures under two headings: primary expenditures and interest payments. In the data belonging to 2006-2017 period, primary expenditures are detailed and the subheadings include "social transfers" and "other transfers to households", which are useful for this study¹. The share of social transfers, other transfers to households and sum of the two items in total central

¹ As mentioned above, the central and general budgets do not include social security institutions. Therefore the social transfers demonstrated here do not contain pensions, survivor, unemployment, sickness and disability benefits, which are paid by Social Security Institution in Turkey.

government budget expenditures are calculated and given in Table 3.2 below. The data illustrates that the share of social transfers in total expenditures increased in time.

Table 3.1 Share of tax revenues in central government budget revenues (%) (2000-2017)

	Tax Revenues/Central Government Budget Revenues
<i>2000</i>	79.26
<i>2001</i>	77.09
<i>2002</i>	78.89
<i>2003</i>	84.11
<i>2004</i>	81.35
<i>2005</i>	77.50
<i>2006</i>	79.25
<i>2007</i>	80.29
<i>2008</i>	80.21
<i>2009</i>	80.03
<i>2010</i>	82.81
<i>2011</i>	85.51
<i>2012</i>	83.85
<i>2013</i>	83.70
<i>2014</i>	82.87
<i>2015</i>	84.47
<i>2016</i>	82.83
<i>2017</i>	85.04

Source: Undersecretariat of Treasury (2018) (own calculations)

Table 3.2 Share of social transfers and other transfers to households in central government budget expenditures (%) (2006-2017)

	Social Transfers / General Government Budget Expenditures	Other Transfers to Households / Central Government Budget Expenditures	(Social Transfers + Other Transfers to Households) / Central Government Budget Expenditures
2006	0.01	0.19	0.21
2007	0.03	0.30	0.34
2008	0.19	0.39	0.58
2009	0.38	0.38	0.77
2010	0.55	0.29	0.84
2011	0.81	0.36	1.18
2012	0.81	1.50	2.30
2013	1.79	0.99	2.78
2014	1.72	0.64	2.36
2015	1.80	1.13	2.93
2016	1.85	1.23	3.08
2017	1.81	1.50	3.31

Source: Undersecretariat of Treasury (2018) (own calculations)

According to the public sector general balance data released by the Ministry of Development (2018), the ratio of net fixed capital investment by public sector to the GDP fluctuated since 2000. The data is shown in following Figure 3.1. The data illustrates that the share of net fixed capital investment in GDP decreased in the first years of 2000s, started to increase in 2004 and stayed near 4% since 2008.

The composition of government fixed capital investment on fixed capital is given for the period 2000-2014 in constant prices (1998=100) (Ministry of Development, 2018). Total investment is divided in to machinery investment and construction investment. The data is illustrated in Figure 3.2 below. Public sector investment in constant prices decreased in the first years of 2000, similar the share of net investment to GDP. The increase after 2004 is more significant. It is obvious that

the level of machinery investment stayed stable and the rise in public sector investment stemmed from the rise in construction investment.

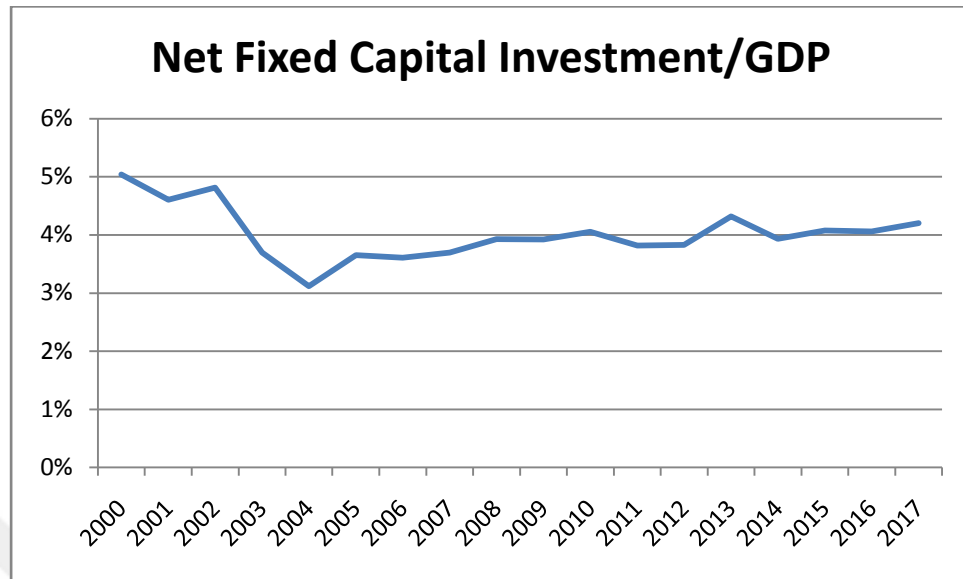


Figure 3.1 Net fixed capital investment by public sector to GDP ratio (2000-2017)

Source: Ministry of Development (2018)

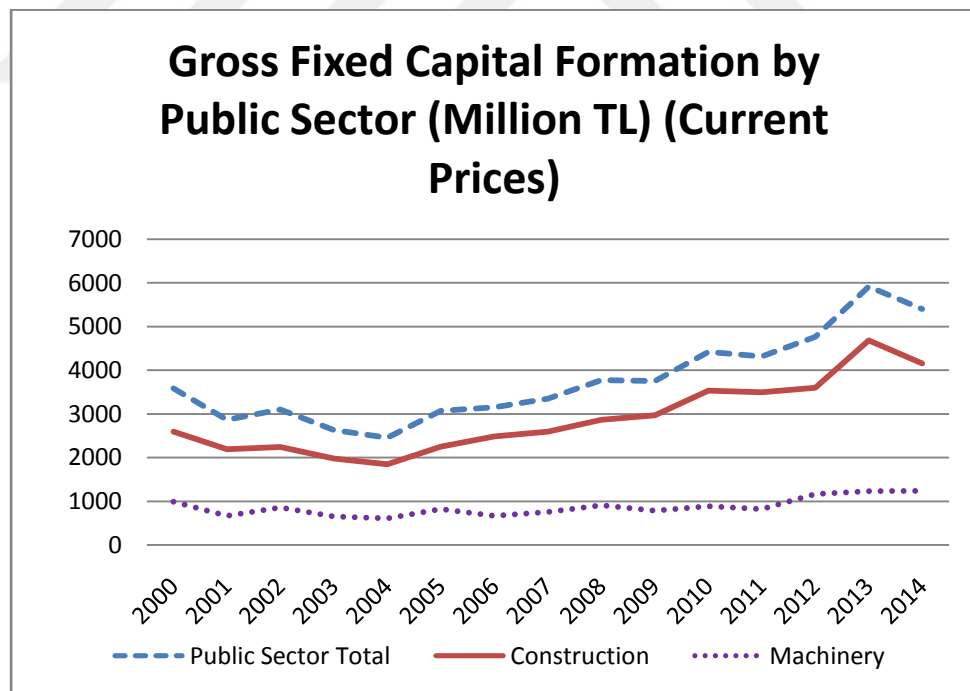


Figure 3.2 Gross fixed capital investment by public sector (machinery and construction shares) (2000-2017)

Source: Ministry of Development (2018)

3.2.2. Public Sector Debt Position

Although domestic public debt is an important issue for majority of countries, it is not explored adequately because concerns about the foreign debt dominate the literature (D'Erasmus & Mendoza, 2016). During European fiscal crisis in the recent past, governments' domestic debt ratios were very high. Domestic debt of government is also high in Turkey; but it is not considered as a hot issue as the foreign debt.

Turkey is a deficit country. Although the country gives a primary surplus, when interest payments are included, the position turns to deficit. During the period covered by this study, Turkish government continued to borrow in order to finance its budget deficit. The ability of revenues to cover the expenditures was low in the beginning of 2000s, but then this ratio improved, with the exception of 2009. Nevertheless, Turkish central government budget did not experience a surplus since 2000s. The ratio of total revenues to total expenditures is given in the following Figure 3.3.

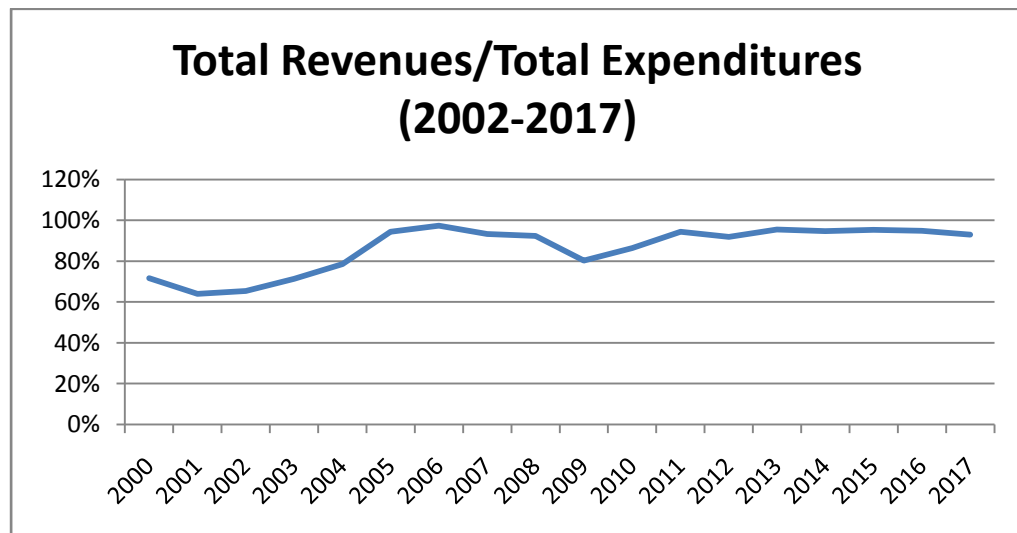


Figure 3.3 Total revenues/total expenditures ratio for Turkey (2000-2017)

Source: Undersecretariat of Treasury (2018) (own calculations)

When the available data on the debt structure of Turkish government is analysed, it is seen that data on total debt stock, interest payments, annual net

borrowing and cost of borrowing, holders of debt, for both domestic and external debt, can be reached. In order to be compatible with purposes of this study the focus is on domestic debt of the government.

In order to understand the debt position of Turkey, first, the gross and net debt stock are analysed. Undersecretariat of Treasury data contains the necessary data under the heading of "Public Net Debt Stock Statistics". The quarterly gross domestic and external debt amounts are given in Turkish liras; net debt stock is calculated by subtracting the Central Bank net assets, public sector assets and unemployment insurance fund net assets from gross debt stock; and then, the amount is divided by GDP. The ratios of gross domestic and external debt to GDP are calculated, using the values given for GDP. The obtained results of calculations are shown in the Figure 3.4 below. Domestic and foreign gross debt stocks are given separately.

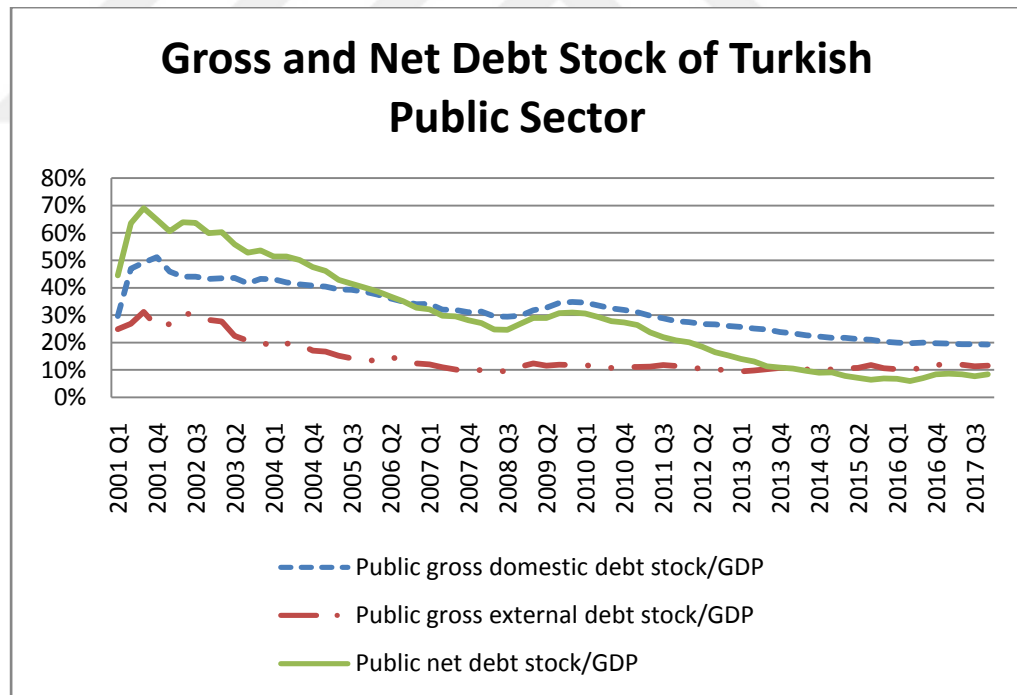


Figure 3.4 Ratio of gross domestic, gross external and net public debt to GDP (2001-2017)

Source: Undersecretariat of Treasury (2018) (own calculations added to original calculations)

The amount of net domestic and external debt is also given in Treasury data (Undersecretariat of Treasury, 2018). The net borrowing of the government sometimes exceeds the budget deficit, and sometimes it is below the budget deficit when the rest of the deficit is financed by privatization revenues or cash money. The ratio of net borrowing to budgetary cash deficit (which is negative for each year in the period of interest of this study) is very volatile. This volatility is shown in Figure 3.5.

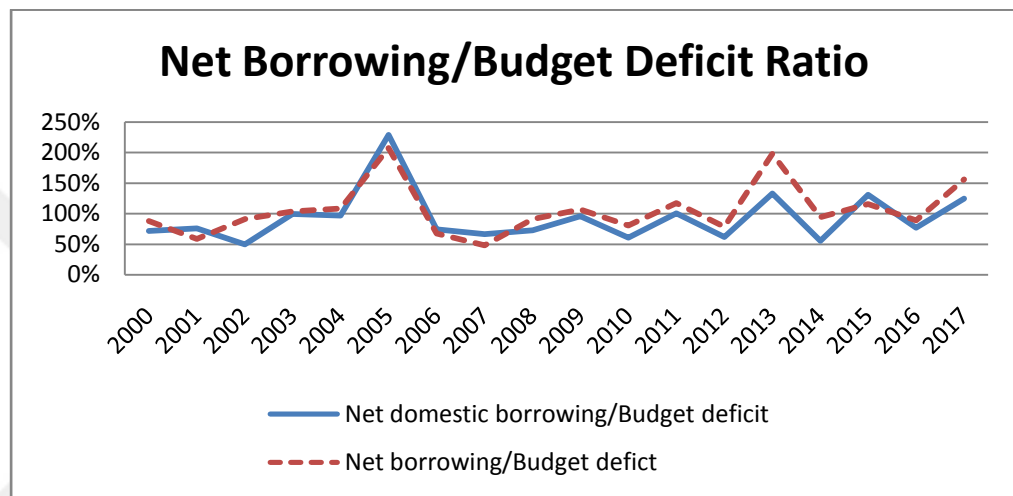


Figure 3.5 The ratio of net borrowing and net domestic borrowing to budget financing (2000-2017)

Source: Undersecretariat of Treasury (2018) (own calculations)

The interest payments are also important for this analysis. As mentioned, Turkish government continues to borrow every year; the finance account is always negative. However, the amount of interest payment does not change in time; so, the ratio of interest payments to total expenditures decreases in time. This can be seen in Figure 3.6.

The ratio of domestic and foreign borrowing to GDP for the public sector indicates that public debt decreased in terms of its ratio to GDP (Ministry of Development, 2018).

Table 3.3 Net borrowing to GDP ratio (%) (2000-2017)

	Net Foreign Borrowing/GDP	Net Domestic Borrowing /GDP	Total Net Borrowing/GDP
2006	2.58	6.76	9.34
2007	-1.58	14.35	12.78
2008	4.84	5.38	10.22
2009	0.50	6.91	7.41
2010	0.78	3.35	4.13
2011	-0.12	0.51	0.39
2012	-0.07	-1.62	-1.69
2013	-0.18	0.46	0.28
2014	0.37	0.74	1.11
2015	0.43	4.15	4.59
2016	0.59	1.87	2.46
2017	0.03	0.23	0.26

Source: Undersecretariat of Treasury (2018) (own calculations)

Average cost of domestic borrowing is calculated using data from Treasury (Undersecretariat of Treasury, 2018). The data in Treasury website includes the monthly interest rate on zero coupon, fixed interest and cash borrowing activities of Treasury and their cumulative annual compound costs. The annual compound costs are taken; average annual compound of the three interest rates are calculated simply by adding them together and dividing by 3. The resulting annual compound cost of domestic borrowing is shown in following Figure 3.7.

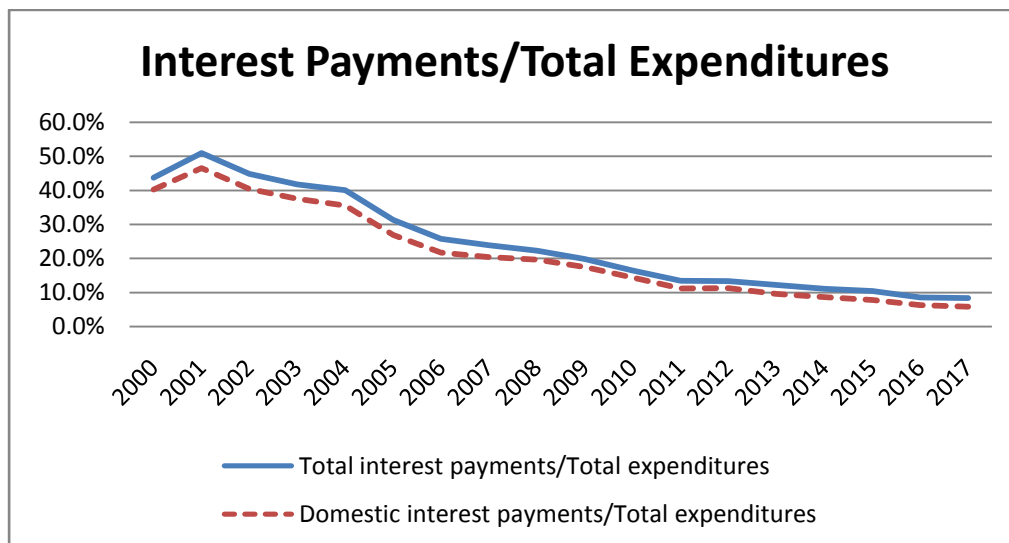


Figure 3.6 Ratio of interest payments to total central government expenditures (2000-2017)

Source: Undersecretariat of Treasury (2018) (own calculations)

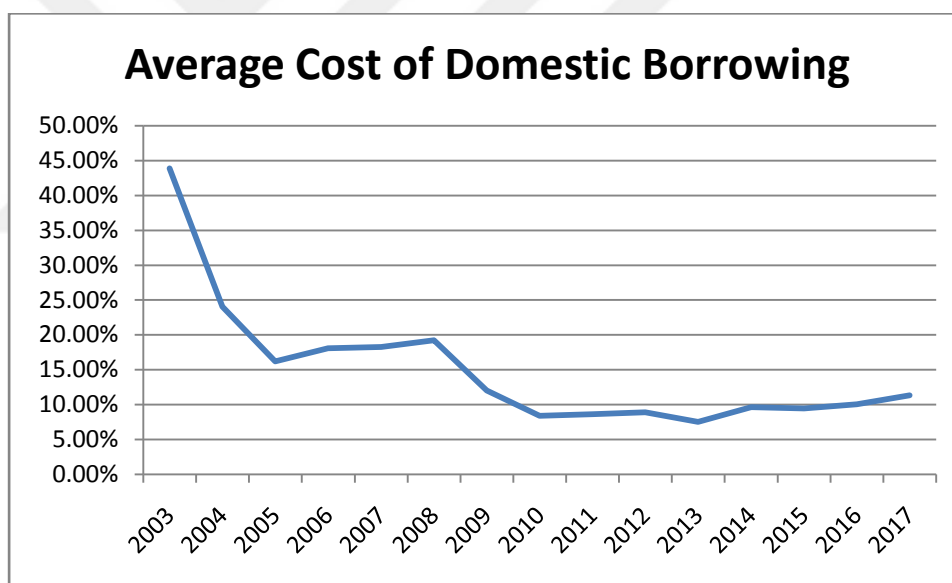


Figure 3.7 Average cost of domestic borrowing (cumulative cost, annual compound) (average of zero coupon, fixed interest and cash borrowing) (2003-2017)

Source: Undersecretariat of Treasury (2018) (own calculations)

Undersecretariat of Treasury (2018) releases the data on the composition of debt stock by holders, under the statistics named "Central Government Debt Statistics". The information on holders of debt securities issued by the Undersecretariat of Treasury and sold in domestic markets is given in the Table 3.4 below.

Table 3.4 Composition of domestic debt stock by holders (%) (2006-2017)

	Banking	Non-Banking Sector			CBRT	Non-
	Sector	Retail	Corporate	Mutual		Residents
		Investors	Investors	Funds		
2004	44.9	14.4	19	6.9	7.6	7.1
2005	47	10.5	17.3	8	6.8	10.3
2006	49.1	8.8	18.1	3.5	6.9	13.6
2007	51.7	5.9	18.5	4.5	6	13.4
2008	55	5.5	19.9	4.8	4.6	10.3
2009	63.4	2.9	18.5	4.2	2.3	8.6
2010	63	1.5	16.9	4	2	12.4
2011	56.7	1.6	18.7	3.8	2	17.3
2012	50.5	0.7	19.8	3.9	1.9	23.2
2013	50.1	0.9	20.6	4.7	2.1	21.5
2014	47.7	0.4	23.2	5.1	2	21.5
2015	48.9	0.3	25.3	6.2	2	17.3
2016	47.6	0.2	25.8	6.4	2.8	17.3
2017	47.1	0.2	24.9	5.8	2.5	19.4

Source: Undersecretariat of Treasury (2018)

The "non-residents" are defined as "investors of debt securities who are residing out of Turkey and the foreign branches of domestic banks"(Undersecretariat of Treasury, 2018). As seen in Table 3.4, the share of retail holders and CBRT decreased substantially in the given period, whereas share of corporate holders and non-residents increased. The decrease in retail investors' share means a decrease in the share of households.

3.3. Analysis of Income Distribution in Turkey

In this section, income distribution in Turkey is analysed using SILC data. The methods used during the calculations are explained in detail. The results are interpreted with respect to the information given in previous sections.

The Survey on Income and Living Conditions is conducted by TURKSTAT since 2006. The data for the years 2006-2016 are released so far. The data is annual. Individuals and households are asked for their living conditions and the income they earned in the previous year. Therefore, each year's data covers the information for the previous year and the available data belong to the years between 2005 and 2015.

In order to focus on the subject of interest of this study, questions about living conditions and corresponding answers are not considered. Instead, answers to the questions about income types are analysed. The survey consists of two questionnaires; one for individuals and one for households. Data about income is collected via both questionnaires. The individuals are numbered with respect to the household they belong to; the incomes of each individual in a household are summed up to the income obtained by the household as a whole, and then, the total income of a given household is calculated and weighted with respect to its representative power the household size. These manipulations are done in *STATA* program.

One problem with the data is that, the questions about income changed during the period. Some new items are added and some items are deleted. The income items in individual questionnaire, their codes and the years they are obtained are as follows:

- FG010 - Total annual net employee cash or near cash income (2006-2016)
- FG020 - Total annual net employee income in kind (2006-2016)
- FG030 - Total annual net self-employment income in cash (2006-2016)
- FG040 - Total annual net self-employment income in kind (2006-2016)
- FG050 - Value of agricultural products produced and used by household (2006-2007)
- FG070 - Unemployment benefits (2006-2016)
- FG080 - Old-age benefits (2006-2016)
- FG085 - Retirement grants (2008-2016)
- FG090 - Survivors' benefits (2006-2016)
- FG100 - Sickness benefits (2006-2016)

- FG110 - Disability benefits (including ghazi and honour pensions) (2006-2016)
- FG120 - Education-related allowances (2006-2016)
- FG125 - Other incomes (2006-2008)

The income items in household questionnaire, their codes and the years they are obtained are as follows:

- HG010 - Annual rental value of the dwelling (2006-2016)
- HG020 - Income received by household members under the age of 15 (2006-2016)
- HG030N, HGH030A - Children-related allowances (2006-2016)
- HG040 - Housing allowances (2006-2016)
- HG050N, HG050A - Other social allowances (2006-2016)
- HG060N, HG060A - Regular allowances from other households (2006-2016)
- HG065N - Alimonies received (2008-2016)
- HG070 - Rental income (2006-2016)
- HG080 - Property income (2006-2016)
- HG085 - Value of agricultural products produced and used by household (2008-2016)
- HG105 - Imputed annual income for individuals not responded (2006-2016)

The income sources are grouped in 8 groups and each of the group includes the following items in SILC data:

1. Labour Income: FG010, FG020
2. Entrepreneur Income: FG030, FG040
3. Rental Income: HG070
4. Financial Income: HG080
5. Social Transfers:
 - Pension and Survivor Benefits: FG080, FG085 (2008-2016), FG090
 - Unemployment and Sickness benefits: FG070, FG100
 - Other Social Transfers: FG110, FG120, HG030N, HG030A, HG040, HG050N, HG050A

6. Inter-household Transfers: HG060N, HG060A
7. Other Income: FG050 (for 2006-2007), FG125 (for 2006-2008), HG010, HG020, HG065N (for 2008-2016), HG085 (for 2008-2016), HG105

The pensions and survivor benefits and unemployment and sickness benefits are social transfers. However they are distributed to people on condition that people are registered workers and they have been working for a given period of time. As mentioned in Subsection 3.2.1, they are paid by Social Security Institution and they are not included in the social transfer figures that are given in Subsection 3.2.1. Therefore they are included under separate headings.

The disposable household income is included in the household data of SILC, with the code HG110. In data manipulations process, the different groups of income of individuals (starting with the letter *F*) belonging to the same household are summed together via a *STATA* code. Then, the household types of income (starting with the letter *H*) are added for each household. Thus, a sum of household income is calculated for each household. In the following calculations, both the total income calculated this way and the disposable income of the household already calculated and reported in surveys are used.

The next step is incorporating the size of household into the calculations. The size of household is important, because economies of scale are assumed. Deaton (1997) defines "public goods" in a household, which are offered to each member without decreasing the welfare of others. Therefore, the per capita income is not found by dividing the total income by total number of household members. Different equivalence scales are used in researches. OECD (2018c) defines in an annotation that three most commonly used equivalence scales are OECD scale (Oxford), modified OECD scale and square root scale. OECD scale and modified OECD scale assign decreasing coefficients for each additional member of the household and each child. In the present study, the square root scale is chosen. The household size is extracted from the data under individual register files for each year; all types of

income and the total income as well as disposable income are divided by the square root of the household size.

In all these calculations households are weighted with respect to a weight parameter. It is important to weight the households with respect to a weight parameter because in surveys, each household represents a different number of households in the total population (Deaton, 1997). This is due to the fact that selection probabilities differ across the groups of countries. Some households can refuse to answer the questions, or reaching some households can be more costly. Household weight parameter is necessary to prevent overrepresentation of some households and underrepresentation of other. The household weight parameter is included in the SILC data with the code HB040 and used in the calculations of the present study.

With this data, four groups of calculations are completed for each year: calculation of Gini coefficient, calculation of shares of each income factor in total income, calculation of factor decomposition for income inequality and calculation of disposable income, social transfer income and financial income shares of population quantiles.

Gini coefficient is calculated using the disposable income given in surveys. The disposable income formula is given in the results as the sum of individual and household incomes minus transfers to other households (and alimonies paid for the years after 2008). The disposable income of each household is divided by the square root of the number of people. The *FASTGINI* command in *STATA* is used. The Gini coefficients are given in Table 3.5 below.

As can be seen in Table 3.5, the income inequality in Turkey calculated with respect to SILC data tends to decrease since 2006. Inequality increased in 2009, following the crisis of 2007-2008. In 2014 and 2015, income inequality tends to increase again.

Table 3.5 Gini coefficient in Turkey (2005-2015)

	Gini Coefficient
2005	0.416
2006	0.399
2007	0.392
2008	0.402
2009	0.389
2010	0.391
2011	0.388
2012	0.388
2013	0.378
2014	0.385
2015	0.395

Source: TURKSTAT (2018b) (Own calculations)

Bükey and Çetin (2017) examine the factors of income inequality in Turkey, using time-series data covering the period 1980 and 2014. According to the results, growth and tax burden are not significant factors on Gini coefficient. Current account surplus is found to be positively related with Gini coefficient; thus increases the income inequality. A slight positive impact is seen between inflation rate and Gini coefficient. Lastly, the interest rate on deposits with 1-year maturity is found to have a slight positive impact on Gini coefficient.

Before analyzing the contribution of different sources of income to income inequality, the weights of different sources of income in total income of households and the change of these weights in years should be analysed. For this aim, the shares of different sources of income in total income of households covered in the SILC survey, weighted with respect to the weight variable, are calculated for the years 2005-2015 and the results are given in the following Table 3.6.

According to the shares of income components given in Table 3.6, labour earnings' share in total income increased, whereas share of entrepreneurship income

decreased. Share of rental income remained around 2-3%. As explained in the previous chapter, with the decrease in real interest rates, the share of financial income decreased. Another explanation for the decrease in households' financial income is related to the composition of domestic debt stock with respect to holders. In 2000s, the share of retail investors in total domestic debt stock by government decreased and the share of banking sector and corporate investors increased significantly (Table 3.4).

An explanation for the increase in the share of labour income in total income is the decrease in unregistered labour in Turkish labour market since 2000s. The share of unregistered labour was more than 50% in total employment in the beginning of 2000s. In 2003, the ratio reached 56%. Then, it began to decrease steadily. In 2005, it became less than 50% and since 2012 the ratio is less than 40%. In 2017, the unregistered labour constituted 34% of total employment (TURKSTAT, 2018a).

The rise in the ratio of registered labour also explains the increase in the share of pensions' and survivors' benefits, unemployment and sickness benefits in total income. As these kinds of social transfers are provided to registered workers and their relatives, it is expected that more people deserve the right to get these benefits when the share of registered labour is high.

The share of social transfers excluding pensions, survivor, unemployment and sickness benefits in total income increased until 2008, but fluctuated near 2% after 2008. As mentioned in Subsection 3.2.1., the ratio of social transfers excluding pensions and survivor, unemployment and disability benefits to total expenditures of the central government increased steadily in that period. Table 3.6 indicates that the increasing share of social transfers in government budget is not reflected in household budget.

Table 3.6 Share of different sources of income in total income of households (%) (2005-2015)

	Labour Earnings	Entrepreneur Income	Rental Income	Financial Income	Social Transfers			Inter- household Transfers	Other Incomes
					Pensions and Survivor Benefits	Unemployment and Sickness Benefits	Other Social Transfer		
<i>2005</i>	39.46	17.63	2.02	4.21	16.38	0.12	1.45	4.33	14.40
<i>2006</i>	36.85	16.49	2.41	4.99	16.60	0.15	1.35	3.68	17.48
<i>2007</i>	40.76	16.40	2.70	2.92	17.41	0.20	1.45	4.39	13.77
<i>2008</i>	39.86	15.08	2.80	3.67	17.68	0.23	1.94	4.54	14.20
<i>2009</i>	39.66	15.63	2.52	3.13	17.87	0.59	2.20	4.20	14.20
<i>2010</i>	41.42	15.71	2.36	2.61	17.55	0.35	1.89	4.11	14.00
<i>2011</i>	42.57	15.12	2.05	2.20	18.31	0.35	2.10	3.85	13.46
<i>2012</i>	44.54	14.68	2.00	2.34	19.14	0.35	1.84	3.57	11.54
<i>2013</i>	44.14	13.62	2.08	2.20	20.31	0.39	1.86	3.73	11.67
<i>2014</i>	44.13	13.13	2.05	1.89	20.52	0.41	2.02	3.60	12.25
<i>2015</i>	44.68	13.24	2.01	1.61	20.90	0.49	1.99	3.57	11.50

Source: TURKSTAT (2018b) (Own calculations)

In order to measure the contribution of each source of income to income inequality, *STATA* command *INEQFAC* is used. This command is based on the seminal work of Shorrocks (1982). Shorrocks (1982) develops a method to measure the contribution of each factor of income to income inequality. In this method, the researcher measures proportionate contribution of any factor to total inequality.

According to the method of Shorrocks (1982), the contribution of an income component to the overall income inequality is calculated by aggregating different components of income over different individuals. If different components of income are denoted by k and individuals are denoted by i , aggregating a specific income component over individuals yields the following overall level for the income component k as follows:

$$Y^k = \sum_{i=1}^n Y_i^k$$

Aggregating all income components yields total income as follows:

$$Y = \sum_{k=1}^K Y^k$$

Given the definitions above, the contribution of each source of income is found by dividing the covariance of each income component with the total income by the variance of total income, as shown in the following equation:

$$s_k^* = \frac{\text{cov}(Y^k, Y)}{\sigma_Y^2}$$

The contributions of different sources of income to income inequality calculated in *STATA* according to this formula are given in Table 3.7.

Table 3.7 Contribution of different sources of income to income inequality in Turkey (%) (2005-2015)

	Labour Earnings	Entrepreneur Income	Rental Income	Financial Income	Pensions and Survivor Benefits	Social Transfers		Inter- household Transfers	Other Incomes
						Unemployment and Sickness Benefits	Other Social Transfers		
<i>2005</i>	33.10	21.23	6.60	12.28	13.05	0.0014	0.06	1.69	11.99
<i>2006</i>	30.33	21.88	10.45	13.61	10.03	0.02	0.05	1.91	11.71
<i>2007</i>	29.38	32.30	6.99	10.13	13.71	0.07	-0.05	1.27	6.21
<i>2008</i>	32.91	24.38	11.03	12.24	12.08	0.03	-0.02	1.04	6.32
<i>2009</i>	27.98	27.25	12.93	9.99	15.47	0.1	-0.14	1.19	5.23
<i>2010</i>	35.34	24.79	9.61	11.97	11.38	0.17	-0.04	1.41	5.36
<i>2011</i>	37.86	20.11	10.46	11.58	13.14	0.14	-0.09	1.24	5.57
<i>2012</i>	36.12	27.51	10.89	7.92	10.97	0.34	-0.18	1.26	5.16
<i>2013</i>	40.42	25.58	8.65	6.82	13.43	0.11	-0.24	2.16	6.06
<i>2014</i>	45.65	21.27	6.82	5.57	12.77	0.19	-0.23	1.98	5.99
<i>2015</i>	35.43	38.20	4.29	7.5	8.37	0.15	-0.14	1.46	4.73

Source: TURKSTAT (2018b) (Own calculations)

Findings summarized in Table 3.7 show that the main source of inequality in income distribution is the inequality of labour earnings and entrepreneur income. In the period covered by the data, the contribution of labour earnings and entrepreneur income to the overall inequality increased considerably. In 2006, 54% of income inequality was explained by labour earning and entrepreneur income, whereas in 2016, this ratio increased to 74%.

The contribution of rental income and financial income to overall income inequality are higher than the shares of these income groups in total income. It is expectable, since the sources of financial income and rental income concentrate in the hands of high-income households. The data of banking accounts indicates that the banking deposits are also highly concentrated in Turkey. Banking deposits data are released by Banking Regulation and Supervision Agency (BRSA). According to the recent data (April 2018), 0.15% of residents who had deposits in banks in Turkey had a deposit of more than one million of Turkish Liras; and 97% of residents who had banking deposits had a deposit of less than ten thousand Turkish Liras. When the total amounts of banking deposits are examined, it is seen that the top 0.16% of the deposit holders, resident in Turkey, owned 54% of deposits whereas 97% of the deposit holders resident in Turkey owned only 3% of total deposits (BRSA, 2018). In a cross-country study of capital income and its impact on income inequality, Fräbldorf et al. (2011), analysed the micro-data belonging to UK, US and Germany, using decomposition method of Shorrocks (1982). The findings of the study are similar to the present study: household capital income has a higher contribution to income inequality than its share in total income, and its contribution to the overall inequality is related to the share it has in total income.

The contribution of rental income and financial income to income inequality decreased within the given period. This result is not surprising because the shares of financial income and rental income in total household income also declined. As mentioned in Subsection 3.2.2, the government debt, both domestic and external, decreased in the period after 2001. This implies that interest revenue from public bonds decreased within the period. The financial income of households, defined by

the related variable (HG080) in SILC data, includes property return from all financial assets, not only from the government bonds. Unfortunately, the participants are not asked about the details of the financial assets they hold. Therefore, the decrease in the contribution of the financial income to the overall inequality and decrease in government debt and interest payments, and in real interest rates, occurred simultaneously.

The pensions and survivor benefits, unemployment and sickness benefits contribute to the income inequality positively. Although they are expected to decrease the income inequality but it is not the case. This can be attributed to the fact that only registered workers and their relative gain right for pensions and survivor benefits and the unemployment benefits and sickness benefits are paid to unemployed or sick workers only if they are (or were) registered to the social security system for a given period of time. In addition, unemployment benefits are paid for a limited time, determined by the period of registered work of the related worker. In such an environment, unregistered workers, or part-time, seasonal workers etc. who already constitute the more fragile portion of the workers cannot benefit from these kinds of social transfers. Social transfers excluding the pensions and benefits improved the income distribution, very slightly, in the majority of years within the covered period. The improving effect of social transfers increased in recent years, except 2015. As demonstrated above, Gini coefficient also increased in 2015.

The SILC data includes total household disposable income, already calculated in the data released by TURKSTAT. Disposable income includes the types of income listed above and a few types of expenditures (some taxes, transfers to other households, alimonies paid etc.) are subtracted from income. In order to analyse the financial income and social transfer income of people belonging to different percentile groups of income, the *STATA* command *PSHARE* is used. The total number of households is separated into 10% quantiles, and their share in total financial income and social transfers are calculated. In Table 3.8 below, results of three selected years (2005-2010-2015) are shown.

Table 3.8 Distribution of disposable income, financial income and social transfers with respect to disposable income quantiles (%) (2005, 2011, 2015)

	2005			2010			2015		
	Disposable Income	Financial Income	Other Social Transfers*	Disposable Income	Financial Income	Other Social Transfers*	Disposable Income	Financial Income	Other Social Transfers*
0-10%	1.98	0.58	16.49	2.40	0.81	15.74	2.54	1.05	23.29
10-20%	3.42	1.36	13.40	3.87	1.57	12.58	3.96	1.47	16.95
20-30%	4.57	2.28	8.46	4.92	2.14	9.06	4.96	1.70	9.65
30-40%	5.65	2.74	9.17	5.93	3.35	7.73	5.86	2.84	8.39
40-50%	6.83	4.12	5.53	7.02	4.39	8.72	6.88	3.36	9.00
50-60%	8.17	5.84	6.86	8.29	5.88	12.45	8.06	4.68	6.90
60-70%	9.79	7.98	10.01	9.78	6.94	9.07	9.53	5.32	6.99
70-80%	12.01	10.51	7.42	11.84	11.19	8.61	11.58	8.88	6.72
80-90%	15.73	13.76	9.81	15.38	14.36	8.78	15.16	12.58	6.22
90-100%	31.85	50.84	12.85	30.57	49.37	7.25	31.46	52.13	5.89

Source: TURKSTAT (2018b) (Own calculations)

*Social transfers excluding pensions and survivor benefits, unemployment benefits and sickness benefits

The distribution of capital income and social transfers among income groups implies that the financial income is distributed more disproportionately than the disposable income. The financial income is earned by high-income groups. Another result implied by this distribution is that social transfers in Turkey are not well-designed to improve the income inequality. The high-income groups obtain social transfers in high proportions with respect to their high incomes.

3.4. Conclusion

Since 2000s, debt stock and net borrowing of public sector in Turkey decreased in terms of their ratios to GDP. The decrease is observed both in the domestic debt and in the foreign debt of the public sector. The decrease in borrowing demand by the public sector results in decrease in the cost of borrowing. Since public sector's borrowing demand is an important determinant of real interest rate, the cost of borrowing would decrease for the whole economy due to the crowding out effect. Although the public sector debt stock and new borrowing declined in 2000s (both in total revenues and with respect to GDP), the fixed capital investment by the government increased since 2004. This public investment is not debt-financed type of investment. On the other hand, the share of taxes in central government budget increased. Finance of public investment can stem from this increase.

It is hard to classify the social transfers by public sector, because social benefits are mainly entitled to those in formal labour market for a long period of time. The social transfers by central government, apart from transfer payments managed by Social Security Institution, increase steadily, but they constitute a very small part of total expenditures. As indicated in this chapter, the contribution of this kind of social transfers to improvement of income distribution is very limited.

While the share of social transfers increased in the total expenditures of central government budget increased, the share of interest payments in total expenditures decreased. It can be concluded that reducing the burden of interest payments on the budget can allow for government policies to improve the income distribution.

The decreasing borrowing demand of public sector and decreasing real interest rate are reflected in the decreasing financial income of households. Financial income is concentrated in the hands of highest income groups. Therefore high borrowing demand and high amounts of interest payment by the public sector contributes to that concentration. Decreasing share of financial income led to decreasing contribution of financial income to the income inequality. Therefore it can be concluded that less borrowing demand by the public sector as a cyclical policy has the potential to improve the income distribution.



4. PUBLIC DEBT AND INCOME DISTRIBUTION: A THEORETICAL FRAMEWORK

4.1. Introduction

The problem of income distribution in an open economy can be analysed with respect to several factors. The effect of government policies on existing distribution of income in an economy is a controversial issue. This study is designed to suggest a theoretical model to find out how government expenditures affect different groups of households in a small open economy.

Distribution issues and how the society can be grouped according to the income take a quite significant place in the related literature. In his seminal paper, Kaldor (1955) summarizes classical, Marxian, neo-classical and Keynesian theories of income distribution. The author illustrates the Keynesian theory as a theoretical model. Kaldor (1955) assumes two groups of households: capitalists and workers. Workers have a smaller propensity to save compared to the capitalists. The gap between the saving propensities of the two types of households is the key element that affects income distribution². The saving propensity of capitalists relative to workers leads to a change in income distribution by modifying the investment-to-output ratio. If the relative propensity to save is small then, small changes in investment-to-output ratio will lead to large changes in the share of profits in GDP, worsening thereby the income distribution. While Kaldor (1955) admits the saving behaviour of workers, the author does not explain which type of assets those workers buy with their savings.

² Kaldor (1955) abstracts from a monetary or fiscal policy as well as other sources of economic fluctuations such as technological change. The paper simply aims at explaining the role of private sector behaviour in income distribution.

Pasinetti (1962) completes the analysis of Kaldor (1955) by assuming that workers also invest in firm shares to receive dividends. This implies that profits are shared among workers and capitalists. The conclusion reached by Pasinetti (1962) is that although the propensity to save of workers influences the distribution of income between capitalists and workers, it has no effect on the distribution of income between profits and wages. This setup reduces the role of workers' saving propensity. The key element becomes the saving propensity of capitalists. The larger the saving propensity of capitalists the smaller is the change in the share of profits in output. This result is similar to the result obtained by Kaldor (1955), except that the workers' saving propensity is no longer a key element for explaining income distribution.

In a Keynesian growth model Palley (1997) introduces the role of goods demand in income distribution. The author assumes that the profit rate depends positively on the growth of goods demand since demand will stimulate investment. The profit rate will fluctuate in order to balance output and goods demand. If the *ex-post* profit rate is higher than the profit rate that assures equilibrium in the goods market, there will be excess saving. In this case, output must decrease, which implies a reduction in the *ex-post* rate of profit. This, in turn, implies an improvement in income distribution in favour of workers. In this setup, the saving propensity of workers is assumed to be equal to zero since the driving force is goods demand.

While the studies cited above are real models without money, Hein (2007) introduces prices which are determined by a mark-up rate, nominal wages and labour/output ratio. This model follows the Kaleckian theory in the sense that it assumes monopoly instead of fully competitive market. In this setup firms are considered as price-makers due to the imperfect competition assumption. Indeed price-setting behaviour of firms influences the profits and induces a variation in income distribution. The share of profit in output depends positively on the mark-up rate. Thus, the relation between the mark-up rate and the interest rate becomes the driving force in the analysis by Hein (2007). If the mark-up rate is rigid (does not respond to changes in the interest rate), then, a variation of the interest rate does not affect real wages but redistributes profits between rentiers' income and profits.

However, if the mark-up rate is interest rate-elastic, an increase in the interest rate will raise the mark-up rate, implying an increase in prices. This, in turn, reduces the real wage while increasing profits and worsens the income distribution.

The literature cited above does not take government, and therefore the fiscal policy, into account. Steedman (1972) introduces government into the Keynes-Kaldor model of income distribution. Specifically, the author considers the effect of balanced-budget fiscal policy on the income distribution. The result is that the rate of profit is not affected by taxes, introduced by the government to finance its spending. On the other hand, the share of wages is negatively affected.

Panico (1997) introduces the possibility of a debt-financed fiscal policy into the framework of Steedman (1972). This modifies the Cambridge income distribution equation by introducing the tax rate. In this setup, in addition to the saving propensity of capitalists, the tax rate also influences the profit rate. As the tax rate increases, the profit rate rises. However, Panico (1997) does not distinguish between different types of government spending, such as public investment or government consumption expenditures. Moreover, the author assumes identical tax rates for different sources of income.

The present setup contributes to the post-Keynesian literature cited above by considering debt-financed public investment expenditures and by imposing different tax rates for different sources of income. In addition, instead of post-Keynesian framework, the present chapter adopts a micro-founded open economy setup. This aspect is important because micro-founded general equilibrium models generally neglect the distributive effects of fiscal policy. Indeed, in micro-founded macroeconomic models with optimizing agents, introducing agent heterogeneity is somewhat difficult since any type of heterogeneity implies an aggregation problem. Thus, the present chapter contributes both to the discussion of income distribution by carrying it out in a new framework and to micro-founded general equilibrium models by introducing distributive fiscal policy. However, the present chapter focuses on the

income distribution as a side effect of discretionary fiscal policies, rather than those aiming directly at improving income equality.

Debates about fiscal policy regained interest in the aftermath of 2008 global economic crisis and the following recession. Fall of aggregate demand forced government to enact fiscal policies (Palley, 2013b). However, the effectiveness of fiscal policies in increasing aggregate demand is still questionable. In addition to the questions about effectiveness, expansionary fiscal policies lead to increases in budget deficits and public debt, which raise questions about sustainability of public debt. According to Palley (2013b), the question whether fiscal policy is effective or not in the short-run can be answered differently depending on which macroeconomic theory is accepted. Fiscal policy, also, has some microeconomic aspects because it can affect individuals' behaviours. The first microeconomic channel of fiscal policy is the effect of public capital on private capital. The second microeconomic channel of fiscal policy is the effect of public expenditure on the household consumption function. Both of these channels are also present in our model.

Another model by Dosi et al. (2013) includes a two-good, agent-based Keynesian economy. There are capital-good industry and consumption-good industry. There is credit demand by firms and banking sector. Mark-up rate determines profit of the firms and decreases dependency on credit; regulates income distribution between wages and profits. Assumption is that workers consume all wages; all profits are invested. Relation to fiscal policy is explained as, when mark-up rate is high, redistributive fiscal policies become a necessity.

In a recent model by Commendatore et al. (2011), the government expenditure enhances labour productivity via purchases from the private sector. In this model, the bargaining power of workers' unions is taken as an important variable. It is concluded that if workers' have bargaining power, the wage share will increase as a result of increase in labour productivity. Although in the present chapter, public investment spending is assumed to increase labour productivity, workers do not have any bargaining power due to perfect competition assumption in the labour market.

This implies that any variation in income distribution will be the result of the fiscal policy itself, rather than market imperfections.

Colacchio (2014) considers government and its interest payments. In this model, workers, firms and government all get debts. The public bonds are only sold to the firms. So, the increase in government expenditures results in a decrease in workers' share.

The present chapter offers a model with two types of households: one of these types of households can save and the other cannot. Different from Kaldor (1955) and its extensions, it is assumed that the asset holder does have a wage income in addition to asset income; so, instead of splitting households as capitalists and workers, the present model splits them as savers and non-savers. This is meaningful to measure the effect of government expenditure on wage-earner households because wage-earners can have very different saving opportunities and habits. Instead of splitting households as capitalist, who earn profit, and workers, who earn wage and profit income; splitting them as households who are wage earners with profit income and without profit income seems more appropriate. Moreover, in the present model, firms are grouped as high-quality and low-quality firms. Including two types of households and two types of firms in the same model aims to measure the effect of government investment expenditure on different agents of the economy.

The numerical results show that an increase in debt-financed public investment spending has heterogeneous effects on different types of households and firms. It improves wage inequality by increasing hand-to-mouth households' wages more than that of asset holder households. In addition, an increase in government investment expenditures leads to an overall increase in output level of the economy.

The rest of the chapter is organized as follows: Section 4.2 introduces the model specifications. Section 4.3 explains calibration of the model variables and the results obtained with the help of computer processing. Section 4.4 presents the sensitivity analysis, which is based on changing the calibrated values of some

variables and presenting the results for alternative calibrations. Section 4.5 concludes.

4.2. The Setup

This chapter considers the case of a small open economy populated by households, firms and the government.

4.2.1. Households

The present chapter considers a small open economy inhabited by a continuum of households indexed on the array $j \in (0,1]$. There are two groups of households and the share of one group is denoted by $0 < \eta < 1$. Within each group of household it is assumed that all individuals are identical. These two groups differ from each other with two aspects: asset holders are assumed to save some portion of their income, whereas the hand-to-mouth households are assumed to consume all their income.

This assumption is similar to Kaldor (1955) and Pasinetti (1962). The authors assume two groups of households are assumed, with different marginal propensities to save. The households are named as "workers" and "capitalists". The marginal propensity to save by the latter is naturally higher. The difference between the marginal propensities to save by the two groups is used to calculate the "sensitivity of income distribution" to changes in investment. In this model, not only two kinds of households are assumed, it is also assumed that one of them does not save at all. This assumption is similar to the model by Hein (2007) where rentiers save some amount of income and get some amount of interest; whereas workers do not save.

The difference between asset holders and hand-to-mouth households is not limited to saving behaviours of these households. A differentiation in terms of educational and working skills is also considered. This allows for a differentiation in wages and thereby justifies the difference regarding saving behaviour across different groups of households.

Campbell and Mankiw (1989) group individuals as permanent income consumers and current income consumers, and they normalized the income to 1, with respect to the income that falls to the shares of these groups: they assumed λ of total income accrues to current income consumers and $(1-\lambda)$ of total income accrues to permanent income consumers.

4.2.1.1. Asset Holders

Asset holders are assumed to be qualified. They are working in high-quality firms. They save some portion of their income and buy dividend. So, they have both labour income and dividend income.

Asset holders decide on how much to consume and how many hours to work. Their utility increases with their consumption (C^{AH}) and decreases with the ratio of number of hours they work in a 24-hour day (H^{AH}). The preferences of a typical asset holder j are given by the following utility function

$$U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} C(j)_s^{AH^\alpha} (1 - H(j)_s^{AH})^{1-\alpha} \quad (4.1)$$

where E is the expectations operator and $0 < \beta < 1$ is the subjective discount factor and $0 < \alpha < 1$ is the elasticity of demand for consumption for an asset holder.

Asset holders earn wage income and interest income. They consume part of their income and invest the rest of it on physical capital, which yields r^d units of income per unit of capital. It is assumed that physical capital is internationally immobile, implying that asset holders rent physical capital only to domestic firms. This assumption is plausible given that net foreign direct investment by Turkish residents is low. According to the international investment position in 2017, Turkey's direct investment on assets were worth of 47,440 million USD, compared to its liabilities of 189,224 million USD (CBRT, 2018).

Thus the budget constraint of a typical asset holder can be written as follows where j index is dropped, since all asset holders are identical:

$$(1-t_w)w_t^{AH}H_t^{AH} + (1+r_t^d - t_a)K_t - C_t^{AH} = K_{t+1} \quad (4.2)$$

In Eq. (4.2), t_w indicates the average percentage tax rate on labour income and t_a indicates average percentage tax rate on dividend income. The wage rate of asset holders is denoted by w^{AH} . The capital stock, represented by K , evolves according to the law of motion given below:

$$K_{t+1} = (1-\phi)K_t - I_t \quad (4.3)$$

where ϕ is the rate of depreciation of physical capital and I is investment.

The typical asset holder maximizes utility given in Eq. (4.1) under the budget constraint given in Eq. (4.2), with respect to C_t^{AH} , H_t^{AH} and K_{t+1} . The first order conditions (FOCs) imply the following equations:

$$H_t^{AH} = 1 - \frac{C_t^{AH}(1-\alpha)}{\alpha w_t^{AH}(1-t_w)} \quad (4.4)$$

$$C_t^{AH\alpha-1}(1-H_t^{AH})^{1-\alpha} = E_t \left[\beta C_t^{AH\alpha-1}(1-H_{t+1}^{AH})^{1-\alpha}(1+r_{t+1}^d - t_a) \right] \quad (4.5)$$

Eq. (4.4) equates the marginal utility of consumption to the marginal utility of leisure, which yields the labour supply decision. According to Eq. (4.4), an increase in consumption leads to a decrease in labour supply. Indeed, an increase in consumption leads to a fall in the marginal utility of consumption which requires an equal decrease in the marginal utility of leisure implying that leisure must increase, labour supply must decrease. Similarly, an increase in wages increases the household's labour supply. Eq. (4.5) is the usual consumption Euler equation which gives the time profile of the asset holder's consumption implying a consumption smoothing behaviour on behalf of the asset holder.

4.2.1.2. Hand-to-Mouth Households

The second group of households are hand-to-mouth households. These households are assumed to be less qualified than asset holder households. Hand-to-mouth households only have labour income. They work in low-quality firms. They consume all their disposable income at each period, implying that they do not save. Their utility function is similar to that of asset-holder households; it increases with consumption, C^{HM} , and decreases with the number of hours asset holders work within a 24-hour day, H^{HM} . The period utility function written in a Cobb-Douglas form is as follows:

$$u_t = C_t^{HM\theta} (1 - H_t^{HM})^{1-\theta} \quad (4.6)$$

where $0 < \theta < 1$ denotes the elasticity of demand for consumption for a hand-to-mouth household.

The budget constraint of a typical hand-to-mouth household is simpler than asset holder households' budget constraint:

$$C_t^{HM} = (1 - t_w) w_t^{HM} H_t^{HM} \quad (4.7)$$

In Eq. (4.7), w^{HM} stands for the wage rate of hand-to-mouth households. The typical hand-to-mouth household maximizes utility given in Eq. (4.6) under the budget constraint given in Eq. (4.7), with respect to C_t^{HM} and H_t^{HM} . Utility maximization implies the following equation:

$$H_t^{HM} = \theta \quad (4.8)$$

Eq. (4.8) equates the marginal utility of consumption to the marginal utility of leisure for a hand-to-mouth household. According to Eq. (4.8), labour supply for a hand-to-mouth household is not affected by the level of consumption; it is constant.

4.2.2. Firms

In this model, two types of firms are assumed: one with high-quality production and the second is low-quality production. Both firms operate in a perfectly competitive market. The products produced by the two are not differentiated. There are similar grouping of firms in relation to the products they produce. The grouping can be as capital-good industry and consumption-good industry (Dosi et al., 2013) or manufacturing firms and distribution firms (Kumhof & Laxton, 2013). In the model by Dosi et al. (2013), the capital-good producing firms produce new technology but the latter group of firms does not. In the model by Kumhof and Laxton (2013), manufacturing firms' use of technology is represented by a Cobb-Douglas production function; whereas distributors produce according to a constant elasticity of substitution (CES) function. In the present model, firms are grouped into two: they use different levels of technology. The main difference between them is the source of physical capital.

4.2.2.1. High-Quality Firms

In the present setup, some firms use high-technology and have a developed production process. These firms employ asset-holder households, who are assumed to be more educated/trained than the hand-to-mouth households. The production function of these firms is in Cobb-Douglas form given below:

$$Y_t^{HQ} = A_t H_t^{AH \delta} K_t^{1-\delta} \quad (4.9)$$

In Eq. (4.9), δ denotes the share of labour in the production. The level of technology, A_t , is assumed to be constant for the sake of simplicity. The profit π can be expressed as follows:

$$\pi_t^{HQ} = Y_t^{HQ} - w_t^{AH} H_t^{AH} - r_t^d K_t \quad (4.10)$$

The firm maximizes its profit given in Eq. (4.10) under the technology constraint, which yields the following FOCs, indicating respectively the capital and labour demand of a high technology firm:

$$K_t = \frac{Y^{HQ}}{r_t^d} (1 - \delta) \quad (4.11)$$

$$H_t^{AH} = \frac{Y^{HQ}}{w_t^{AH}} \delta \quad (4.12)$$

According to Eq. (4.11), the demand for capital decreases when the cost of one unit of capital increases. Indeed, a decrease in the rental rate of capital, r_t^d , leads to an increase in demand for capital. The marginal productivity of capital becomes equal to the price of capital. Similarly, Eq. (4.12) gives the demand for labour and equates marginal productivity of labour to the price of labour. When the unit cost of labour increases, demand for labour decreases, and vice versa.

4.2.2.2. Low-Quality Firms

Low quality firms have a labour intensive technology in the sense that they do not invest in physical capital. However, they benefit from public capital which is assumed to contribute to the production process. Their production function is in Cobb-Douglas form:

$$Y_t^{LQ} = A_t (H_t^{HM})^\gamma (G_t^i)^{1-\gamma} \quad (4.13)$$

where G_t^i is the government investment expenditure³ and γ is the share of labour in the total production in the low-quality sector. These firms have a simpler production cost function because they do not have a capital stock of their own; they only have labour cost. Their profit function is as follows:

$$\pi_t^{LQ} = Y_t^{LQ} - w_t^{HM} H_t^{HM} \quad (4.14)$$

³ In order to introduce a significant difference between high and low quality firms, public capital is assumed to benefit to low-quality firms alone. In addition, public capital is assumed to depreciate totally each period for simplification purposes.

When profit-maximizing condition is applied, the following equation for labour demand by low-quality firms is obtained:

$$H_t^{HM} = \frac{Y^{LQ}}{w_t^{HM}} \gamma \quad (4.15)$$

Eq. (4.15) gives the demand for labour and equates marginal productivity of labour to the price of labour. When the unit cost of labour increases, demand for labour decreases, and vice versa.

4.2.3. Government

In this model, government has tax revenues and spends an amount of G^i each period⁴. Superscript (i) is used to denote that the government expenditure is done for infrastructural investment for the low-quality firms. The government revenues in this model include labour-income taxes and capital-income taxes, similarly to Colacchio (2014). Kumhof & Laxton (2013) assume lump sum taxes. In addition, transfer payments are omitted for the sake of simplicity. Thus, the government Budget Balance (BB) can be expressed as follows:

$$BB_t = t_w((1-\eta)w_t^{AH}H_t^{AH} + \eta w_t^{HM}H_t^{HM}) + t_a K_t - G_t^i \quad (4.16)$$

Budget balance is determined endogenously. Therefore, it can take positive or negative values. Negative values of budget balance imply that taxes are not sufficient for public expenditures and the government issues bonds. By assumption, government bonds are bought only by non-residents.

In this model, public investment expenditure G^i is taken as a first-order autoregressive process, with a one-time i.i.d. shock denoted by ε_t :

$$\ln G_{t+1}^i = \rho \ln G_t^i + \varepsilon_{t+1} \quad (4.17)$$

⁴ Other types of government expenditures are excluded in the present chapter. However, the effect of public consumption expenditure will be considered in the next chapter.

The parameter ρ is the autocorrelation of government expenditure shock; and it is assumed that $\rho \in (0,1)$.

4.2.4. Rest of the World

As this is a small open economy, the country has a Current Account Balance (CAB), which is given as follows:

$$CAB_t = (Y_t^{HQ} + Y_t^{LQ}) - [(1-\eta)C_t^{AH} + \eta C_t^{HM} + I_t + G_t^i] \quad (4.18)$$

Budget Balance and Current Account Balance of the country are assumed to be equal to each other, since it is assumed that public bonds, which are the only internationally-traded assets, are held only by non-residents whereas the residents hold profit shares only. This is similar to other models (Kumhof & Laxton, 2013). Combining Eq. (4.16) and Eq. (4.18) yields the following condition for the external equilibrium:

$$t_w [(1-\eta)w_t^{AH} H_t^{AH} + \eta w_t^{HM} H_t^{HM}] + t_a K_t = Y_t^{HQ} + Y_t^{LQ} - (1-\eta)C_t^{AH} - \eta C_t^{HM} - I_t \quad (4.19)$$

A separate debt variable is not included in this model. The budget balance, and the current account balance, which is equal to the budget balance, gives us the saving or debt position of the government. As there is not any interest payment included in the budgetary and current account balances, the positive/negative value of these accounts implies primary surplus/deficit. As the focus of the study is the effects of public expenditure and public debt, private debt is not included; it is assumed that only government can borrow from foreigners.

4.2.5. General Equilibrium

Total labour supply, given by $H_t = \eta H_t^{AH} + (1-\eta)H_t^{HM}$ must equal total labour demand. Similarly, total private goods demand, given by $C_t = \eta C_t^{AH} + (1-\eta)C_t^{HM}$, must equal total goods supply. The general equilibrium is given by the sequences for the choice variables

$\{C_t^{AH}, C_t^{HM}, H_t^{AH}, H_t^{HM}, Y_t^{HQ}, Y_t^{LQ}, I_t, K_{t+1}\}_{t=0}^{\infty}$, the prices (expressed in real terms) $\{w_t^{AH}, w_t^{HM}, r_t^d\}_{t=0}^{\infty}$ and the policy instruments $\{G_t^i\}_{t=0}^{\infty}$ satisfying the following equilibrium conditions:

- i. Labour supply (Eq. (4.4) and Eq. (4.8)) equals labour demand (Eq. 4.12 and Eq. 4.15)
- ii. Good market clears, implying that output given by the production function (Eq. (4.9) and Eq. (4.13)) equals demand, expressed as the sum of world public and private consumption along with investment given the initial conditions for K_0 and G^i .

The model is composed of 12 equations and 12 unknowns. The equations that make up the model are given in Appendix A. The steady-state equilibrium is given in Appendix B. The relevant equations are log-linearized around the steady-state according to the method given in Ziets (2006). The log-linear version of the model is given in Appendix C.

4.3. Calibration and Results

This section discusses the values assigned to the parameters and gives the results in the form of impulse responses to a 1% temporary increase in government investment spending financed both by taxes and public debt.

4.3.1. Calibration

Since the model is non-linear, in order to solve the model, one must log-linearize the relevant equations around the steady-state by applying a 1st order Taylor expansion. As the model is dynamic with infinite horizon, only a numerical solution can be obtained. The steady-state is defined as the initial equilibrium where all growth rates are equal to zero, and there is no public debt. Given the rational expectations structure, the solution to model can be expressed in the form of impulse response functions (IRFs) generated by *Matlab*.

In order to solve the model, numerical values must be assigned to the parameters. It is assumed that α , the parameter which determines the role of consumption in asset holder households' utility function equals 0.79. The parameter θ , which determines the role of consumption in utility function of hand-to-mouth households, is set to 10/24; which implies that the steady-state labour supply of hand to mouth households equals 10/24.

It is assumed that the asset holder households work for 8 hours a day, so the steady-state value of H^{AH} is taken as 8/24. Hand-to-mouth households are expected to work more than asset holder households. Although the assumption of lower wages for hand to mouth households may provide an incentive to work less, it is assumed that the income effect outweighs the substitution effect.

The parameter δ is in Cobb-Douglas production function of high-quality firms that determine the weight of labour productivity in total production. It is assumed to be high since the employees of these firms are defined as more educated compared to hand to mouth households. The parameter in Cobb-Douglas production function of low-quality firms, γ , on the other hand is assumed to be lower. These parameters are taken as 0.75 and 0.525 respectively.

In this theoretical model, the share of hand-to-mouth households is assumed to be lower than the number of asset holder households. Accordingly, η is taken as 0.825. The steady-state value of Y^{LQ}/Y^{HQ} is arbitrarily set to 1/4 implying that relative output of low-quality firms is 25%. Alternative values will be considered for sensitivity analysis.

The symbol β is the discount factor in the utility function for asset holder households is assumed to be equal to 0.99 which is the standard value accepted in the literature. The parameter β is related to the steady-state real interest rate. In order to achieve plausible values for the steady-state real interest rate, β must be high. The value taken in the present chapter is not significantly different than the value taken in Voyvoda and Yeldan (2005), who assume $\beta = 0.9775$.

Annual depreciation rate of private capital is symbolized by ϕ and it is taken as 0.025. The autocorrelation coefficient of the shock variable is shown by ρ and taken as 0.9. Tax rate on capital income, t_a , is considered to be constant. It is assumed to be 5%. Tax rate on wage income, t_w is also constant and set so as to match the steady-state values of other variables given in Table 4.1 below.

Table 4.1 Calibrated parameters and steady-state levels used in the model

Calibrated Values		
α	0.79	Elasticity of demand for consumption in asset holder households' utility function
β	0.99	Subjective discount factor
δ	0.75	Output elasticity of labour (share of labour in total production) in high-quality firms
γ	0.525	Output elasticity of labour (share of labour in total production) in low-quality firms
ρ	0.9	Persistency of shock
ϕ	0.025	Depreciation rate
$\overline{H^{AH}}$	8/24	Ratio of hours of work in a day by asset holder households
θ	10/24	Ratio of hours of work in a day by hand-to-mouth holder households (equal to elasticity of demand for consumption in hand-to-mouth households' utility function)
η	0.825	Rate of hand-to-mouth households in total population
$\overline{Y^{LQ}}/\overline{Y^{HQ}}$	0.25	Steady-state output of low-quality firms relative to the output of high-quality firms
t_a	0.05	Tax rate on asset revenues

The calibration is designed to keep the asymmetric structure (heterogeneity) of the model. Specifically, the calibrated values are chosen such that the steady-state wage levels are different across households and steady-state output levels are different across firms. Alternative calibrations are also possible. Therefore,

sensitivity analysis will be provided in Section 4.4 in order to measure the robustness of the results to a variation of the calibrated values. Specifically, alternative values to η , $\overline{Y^{LQ}}/\overline{Y^{HQ}}$ and t^a will be assigned.

The values assigned to the parameters given above will allow solving the model numerically, which implies generating impulse response functions using *Matlab* according to the solution method for rational expectations models (see Appendix-D for the solution method).

4.3.2. Results

The present chapter considers the case of a one-time unanticipated increase in government investment spending equal to 1% of the steady-state value. As government revenue (taxes) are designed as endogenous, some of the public spending will be debt-financed (negative budget balance) as implied by the government budget constraint given in Eq. (4.16).

The steady-state values of some indicators are given in Table 4.2. In order to assess the steady-state, the ratios of macroeconomic variables to the total output of the country, GDP or Y , which is equal to the sum of Y^{HQ} and Y^{LQ} , are calculated and demonstrated explicitly. The ratio of current account and government balance to GDP is 14.5%. This is acceptable as they represent primary balance. The ratio of government investment expenditure in GDP is 5.7% and total investment to GDP ratio is 8.3%. The real interest rate is 6% and tax on labour income is 18.4%. Although the real interest rate and current account surplus are high, investment and government investment spending to output ratios are acceptable for Turkish economy.

Table 4.2 Selected numerical results of the model

Selected Numerical Results	
$\overline{CAB/Y}$	0.145
$\overline{G^i/Y}$	0.057
$\overline{I/Y}$	0.083
r^d	0.06
t_w	0.184

The increase in government expenditure is a typical AR (1) process. Since government expenditure is used as infrastructure in low quality firms, as implied by Eq. (4.13), the production of low-quality firms (Y^{LQ}) increases following the public investment shock (see Panel b in Figure 4.1). Consequently, demand for hand-to-mouth household labour, which are used in low-quality firms, increases and this leads to an increase in wages of hand-to-mouth households for a given labour supply. The consumption of hand-to-mouth households also rises following the increase in wages implied by Eq. (4.7). Number of hours of work is constant for hand-to-mouth households; therefore, as wage rises, consumption increases (see Panel e in Figure 4.1).

The decrease in interest rate leads to a decrease in savings of asset-holder households. Savings of asset holders are used to buy capital stock, as implied by Eq. (4.2). As a result of decreasing savings, the capital stock used in high-quality firms decreases (see Panel c in Figure 4.2). This leads to a decrease in output of high-quality firms.

The increase in total (public and private) demand exceeds the increase in output. As a result, the country current account surplus decreases (see Panel d in Figure 4.2). This implies that budget surplus also decreases.

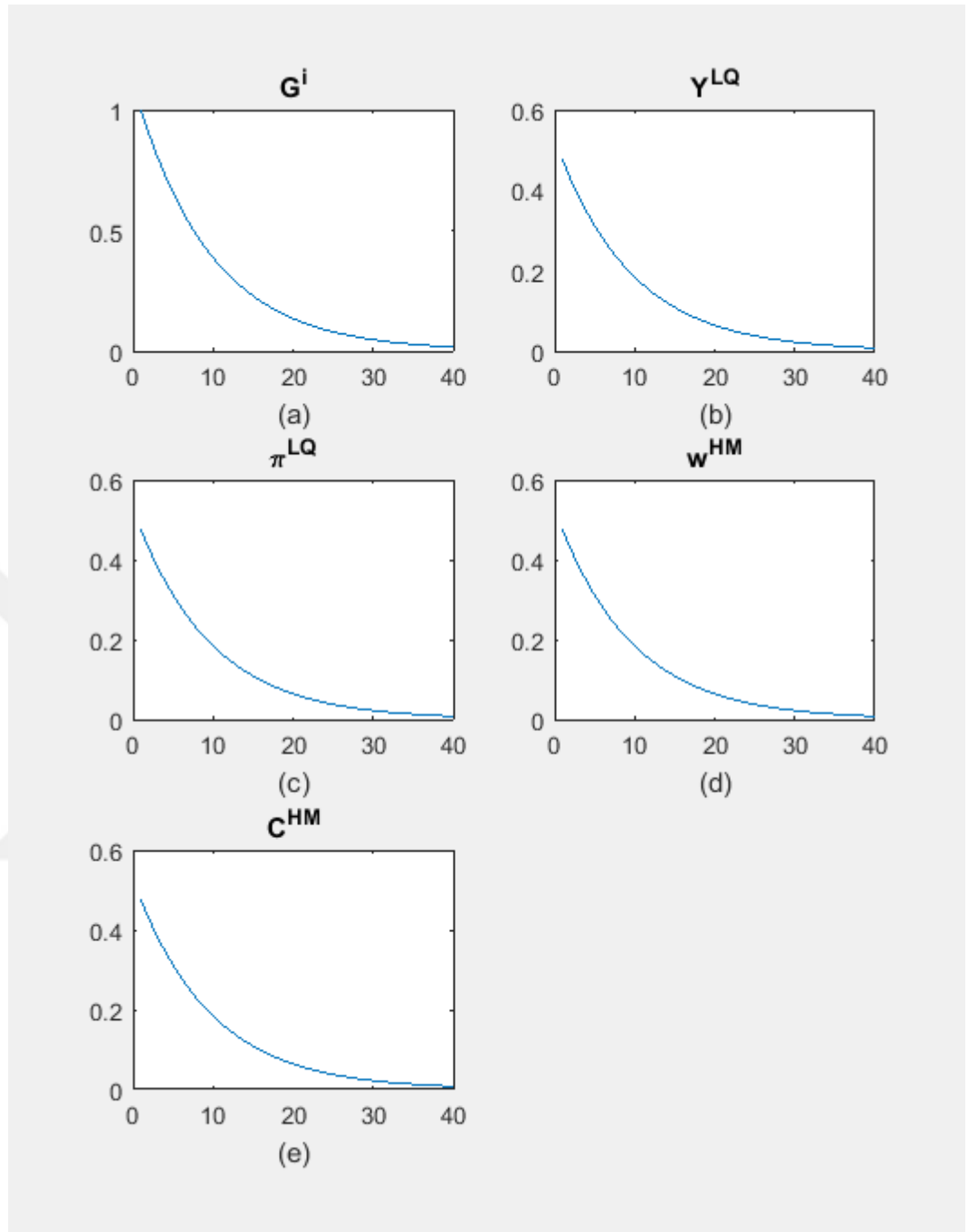


Figure 4.1 The effect of public investment shock on low-quality firms and hand-to-mouth households

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state*

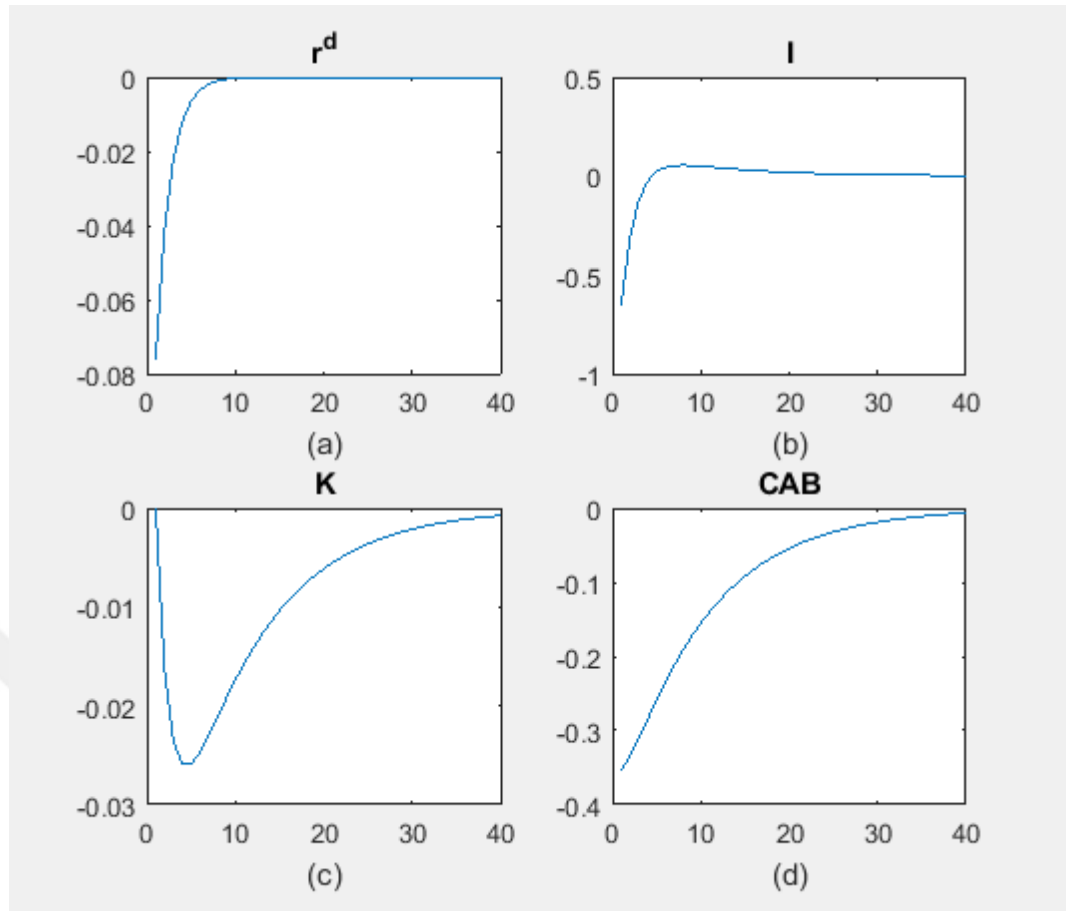


Figure 4.2 The effect of public investment shock on private sector and current account balance

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state*

As interest rates decrease, the asset holders consume more (see Panel d in Figure 4.3). The rise in asset holder's consumption implies a fall in the marginal utility of consumption. The labour-leisure trade-off (Eq. 4.4) requires a fall in the marginal utility of leisure implying that asset holders switch out of labour into leisure. This explains the reduction of hours worked by asset holders (see Panel e in Figure 4.3).

The labour supply to high-quality firm decreases, and at the same time, the production by high-quality firm also decreases. The effect of decreasing labour demand surpasses the effect of decreasing production, and the wages of asset holders increase (see Panel c in Figure 4.3).

Profit of high-quality firms decrease at first, as wages of asset holders increase. The decrease in interest rate, on the other hand, affects profits positively and profits increase for a while (see Panel c in Figure 4.3).

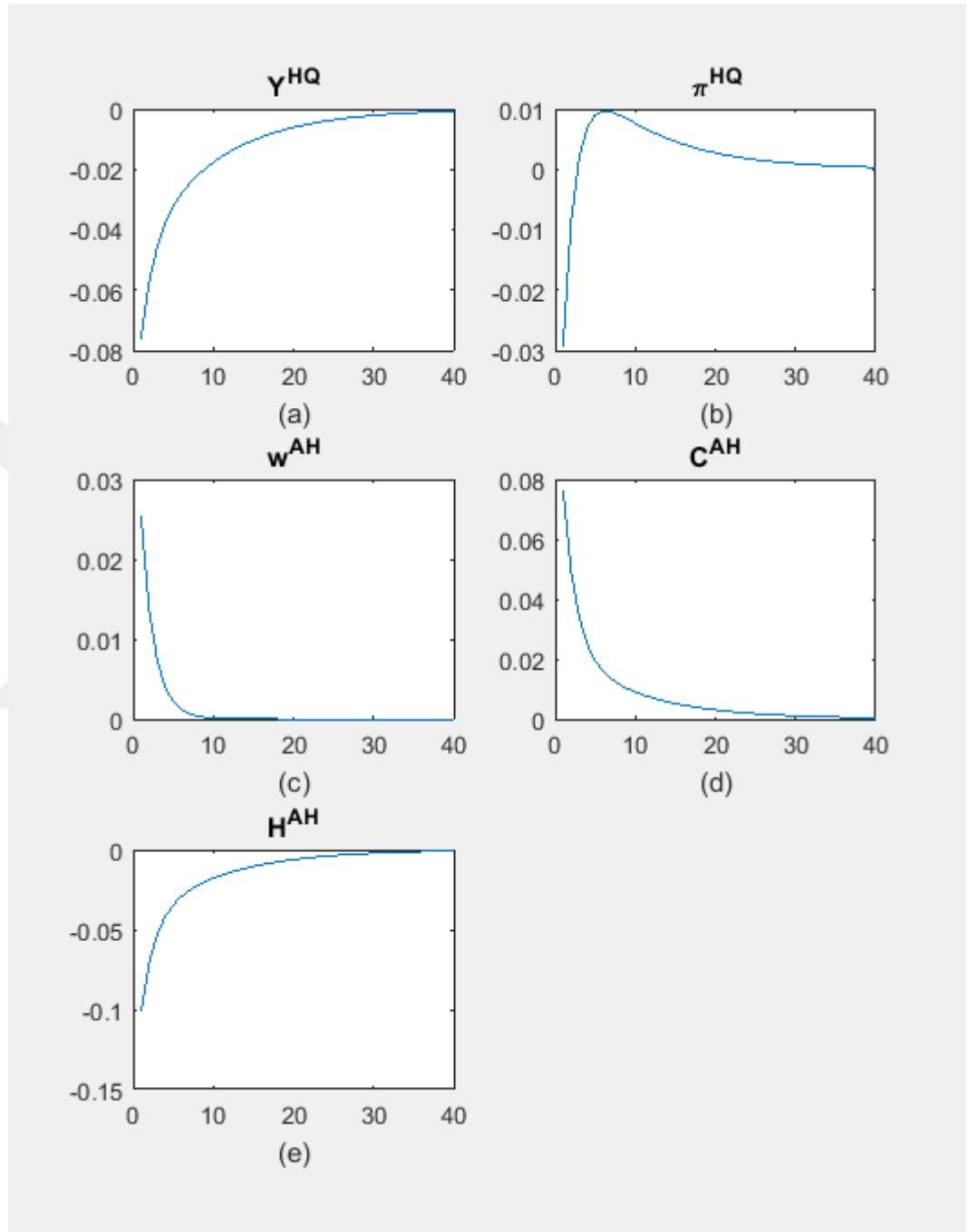


Figure 4.3 The effect of public investment shock on high-quality firms and asset holders

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state*

When the income distribution is considered, it is seen that a temporary rise in government expenditures leads to an increase in wages of both asset holders and hand-to-mouth households. However, the consequent rise in the wages of asset holders is very limited compared to the rise in the wages of hand-to-mouth households. The result is similar to the responses of consumption level of the two groups of households. The findings imply that a temporary rise in government expenditure improves the income distribution by leading to a bigger increase in the wages of hand-to-mouth households compared to the increase in wages of asset holder households.

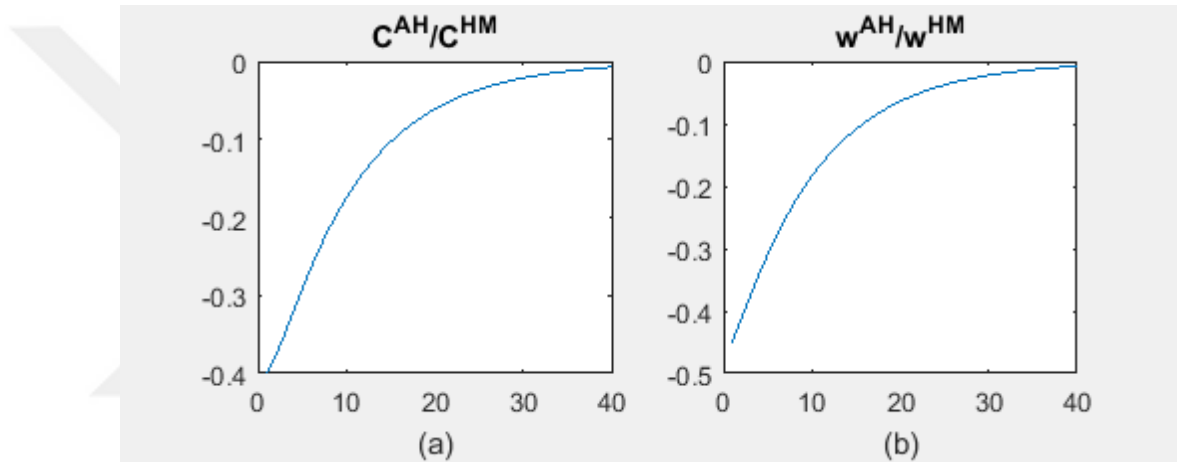


Figure 4.4 The effect of public investment shock on income distribution

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state*

4.4. Sensitivity Analysis

In this section, three alternative calibrations are presented to measure the robustness of the model. Alternative values for η , $\overline{Y^{LQ}}/\overline{Y^{HQ}}^Q$ and t^a are replaced in the calculations one by one.

In Alternative Calibration - 1, η , the ratio of hand-to-mouth households to the total population, is set to 0.5, instead of 0.825. The selected numerical results are given in Table 4.3 below.

Table 4.3 Selected numerical results under Alternative Calibration - 1

Selected Numerical Results	
$\overline{CAB}/\overline{Y}$	0.39
$\overline{G^i}/\overline{Y}$	0.057
$\overline{I}/\overline{Y}$	0.083
r^d	0.06
t_w	0.797

When the ratio of hand-to-mouth households to total population is reduced (so, the ratio of asset holders is increased), the steady-state value of the current account surplus (primary balance) increases. Government expenditure and investment ratios to total output in steady-state remain constant. Tax rate on income increases substantially.

The impulse responses of variables in Alternative Calibration - 1 are given through Figures 4.5-4.8 below. As seen in Figure 4.5, this alternative calibration does not lead to any change in low-quality firms and hand-to-mouth households. The labour supply by hand-to-mouth households does not change, because it is a constant (equal to θ as specified in Eq. (4.8)). As a result, a change in η does not lead to a change in Y^{LQ} and w^{HM} (see Panels b and d in Figure 4.5).

The interest rate decreases further (see Panel a in Figure 4.6), leading to a higher decrease in capital and investment. Current account surplus decreases, but it decreases less, compared to the benchmark calibration. Y^{HQ} decreases more, C^{AH} increases more (see Panel a and d in Figure 4.7), Y^{LQ} and C^{HM} are constant. All these imply a higher decrease in current account surplus. However, investment decreases in a higher ratio (more than 1%). Therefore the reduction in current account remains less than its reduction under benchmark calibration.

Profit of high quality firms decreased in a higher ratio than the benchmark model. The effect of variables on profit, with respect to the benchmark model are given as: Output of high-quality firms decreased more than the benchmark model (negative effect on profits), wages of asset holders increased more (negative effect on profits), hours of work by asset holders decreased more (positive effect on profits), interest rate decreased more (positive effect on profits) and capital stock decreased more (positive effect on profits). Therefore, the lower decrease in profits under this calibration indicates that the effect of output and wage decrease surpassed by the other variables.

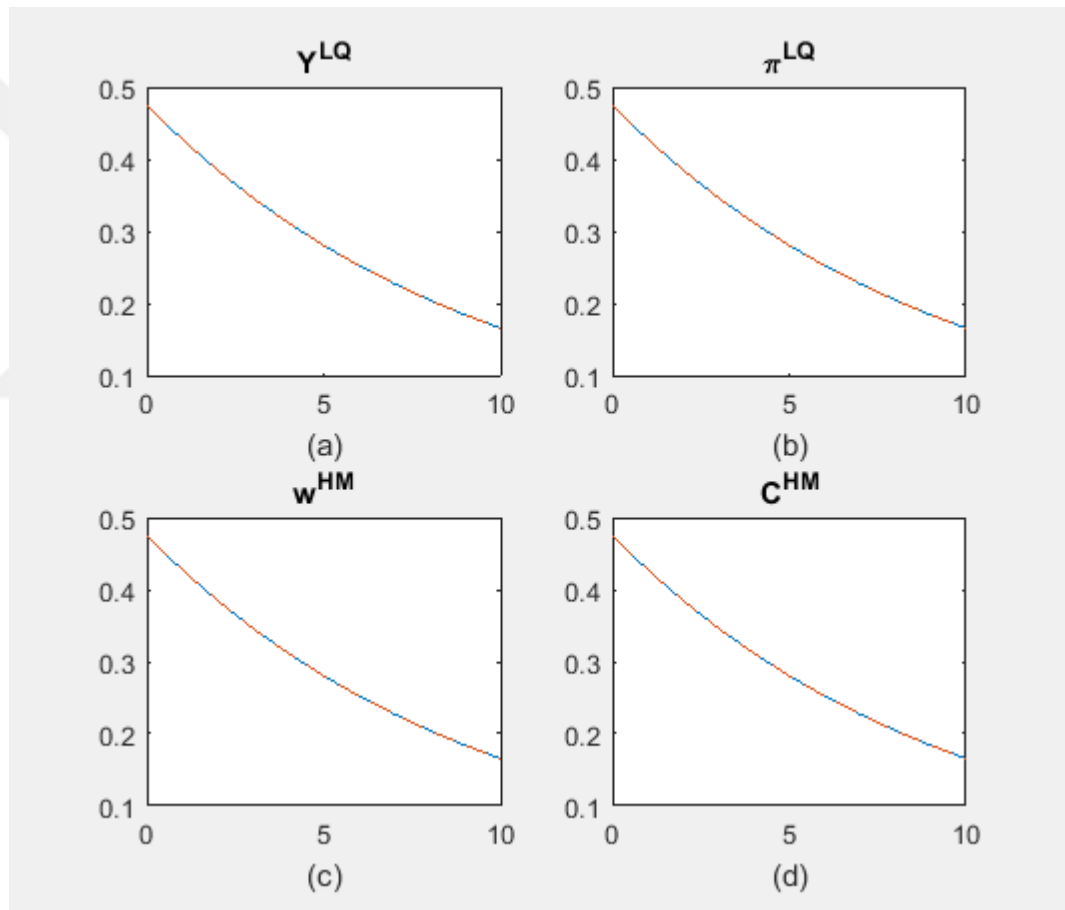


Figure 4.5 The effect of public investment shock on low-quality firms and hand-to-mouth households under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

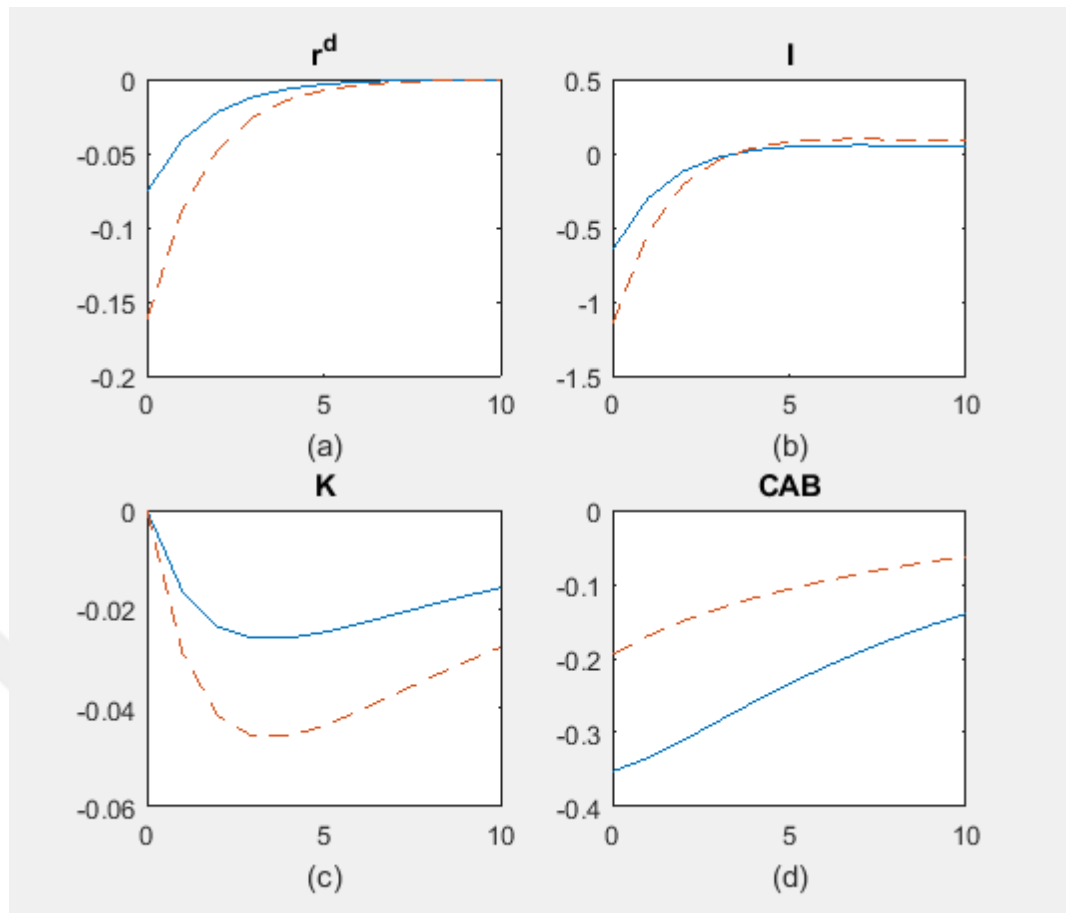


Figure 4.6 The effect of public investment shock on private sector and current account balance under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

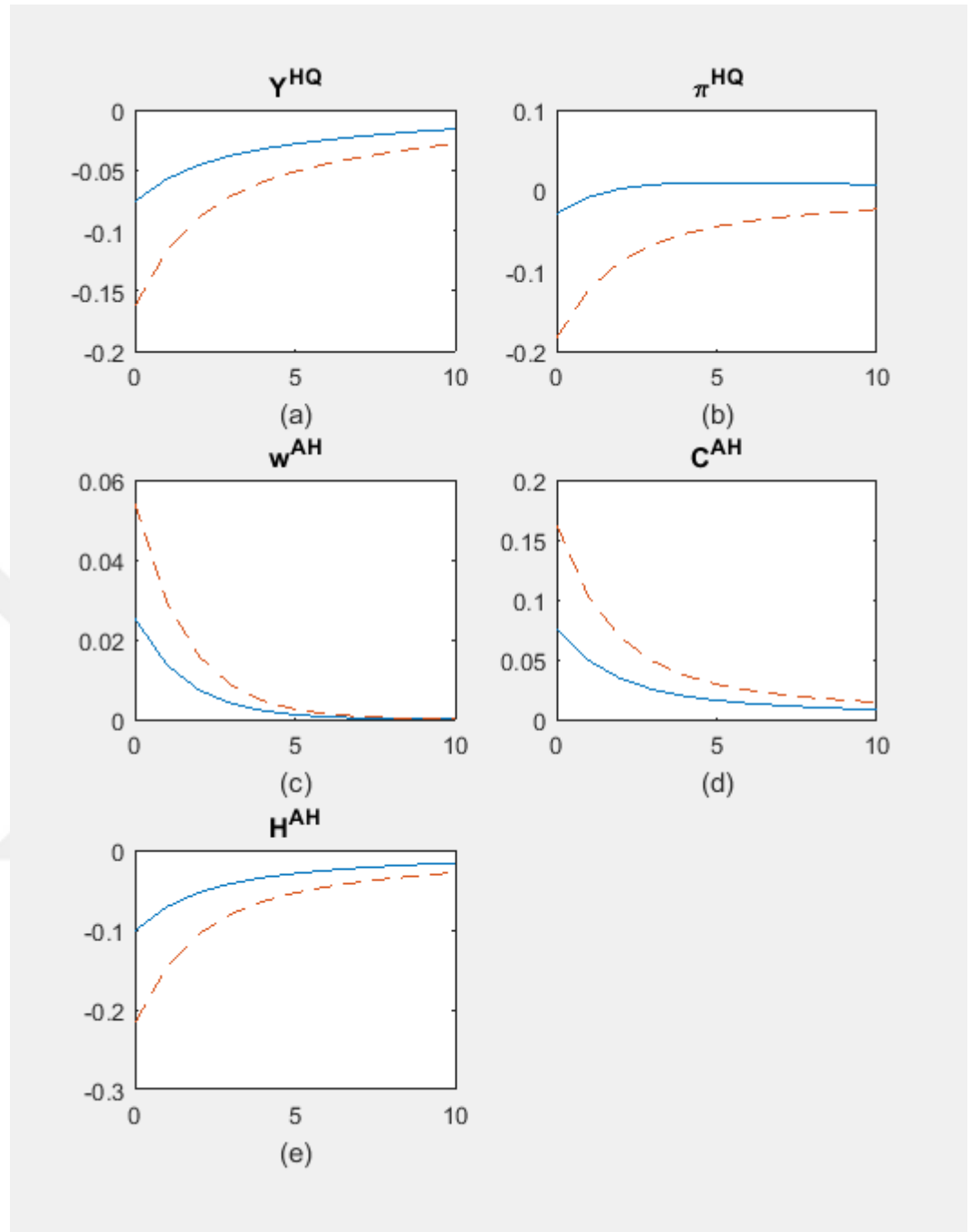


Figure 4.7 The effect of public investment shock on high-quality firms and asset holders under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

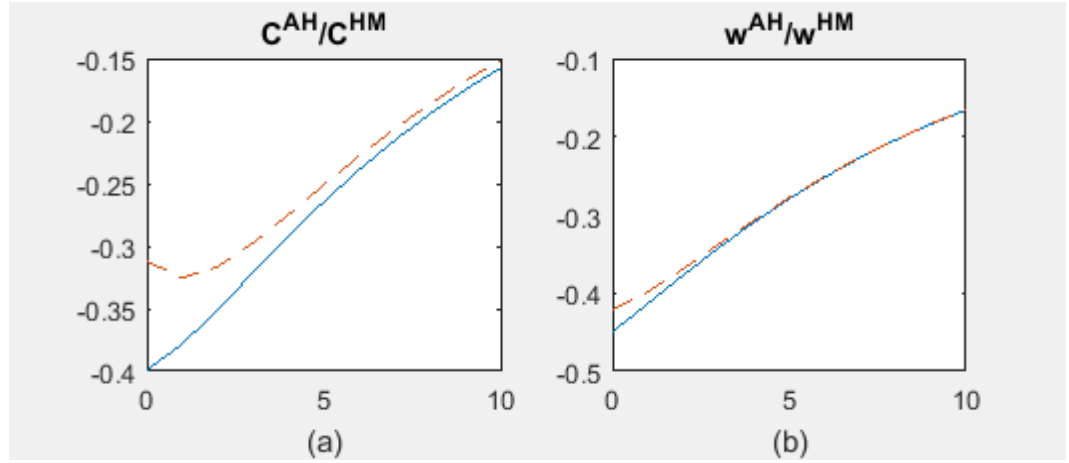


Figure 4.8 The effect of public investment shock on income distribution under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

When η is decreased, the wage and consumption of asset holders increased in higher ratios compared to their increase under benchmark calibration. The wage inequality still improves in this framework. Wage of asset holders increases more, but it is still below the rate of increase in wage of hand-to-mouth households. This is also valid for the relative consumption levels (see Figure 4.8). Therefore the decrease in η reduces the improving effect of government investment shock on income inequality.

In Alternative Calibration - 2, $\overline{Y^{LQ}}/\overline{Y^{HQ}}$ is set to 0.1, instead of 0.25. Values of selected indicators are given in Table 4.4 below. The impulse responses of variables under Alternative Calibration - 2 are given in through Figures 4.9 and 4.12. The effect of a decrease in $\overline{Y^{LQ}}/\overline{Y^{HQ}}$ is in the opposite direction of the changes under the Alternative Calibration - 1.

Table 4.4 Selected numerical results under Alternative Calibration - 2

Selected Numerical Results	
$\overline{CAB/Y}$	0.2246
$\overline{G^i/Y}$	0.0094
$\overline{I/Y}$	0.0945
r^d	0.06
t_w	0.2835

When $\overline{Y^{LQ}/Y^{HQ}}$ is decreased, the steady-state value of the current account surplus increases. Government expenditure ratio to total output decreases whereas investment to output ratio increases. Tax rate on wage income also rises.

As seen in Figure 4.9, this alternative calibration does not lead to any change in low-quality firms and hand-to-mouth households. The interest rate decreases less (see Panel a in Figure 4.10), leading to a lower decrease in capital and investment. Current account surplus decreases less, compared to the benchmark calibration. Y^{HQ} decreases less, C^{AH} increases less, I decreases less (see Panel a and d in Figure 4.11), Y^{LQ} and C^{HM} stay constant. All these imply a lower decrease in current account surplus. Therefore the decrease in current account remains less than its decrease under benchmark calibration.

Profit of high quality firms decreased in a higher ratio than the benchmark model. The relative changes in variables affecting profit of high quality firms are as follows: Output of high-quality firms decreased less than the benchmark model (relatively positive effect on profits), wages of asset holders increased less (relatively negative effect on profits), hours of work by asset holders decreased less (negative effect on profits), interest rate decreased less (negative effect on profits) and capital stock decreased less (negative effect on profits). Therefore, the lower decrease in profits under this calibration indicates that the effect of the lower decrease in output surpassed by higher increases in other variables.

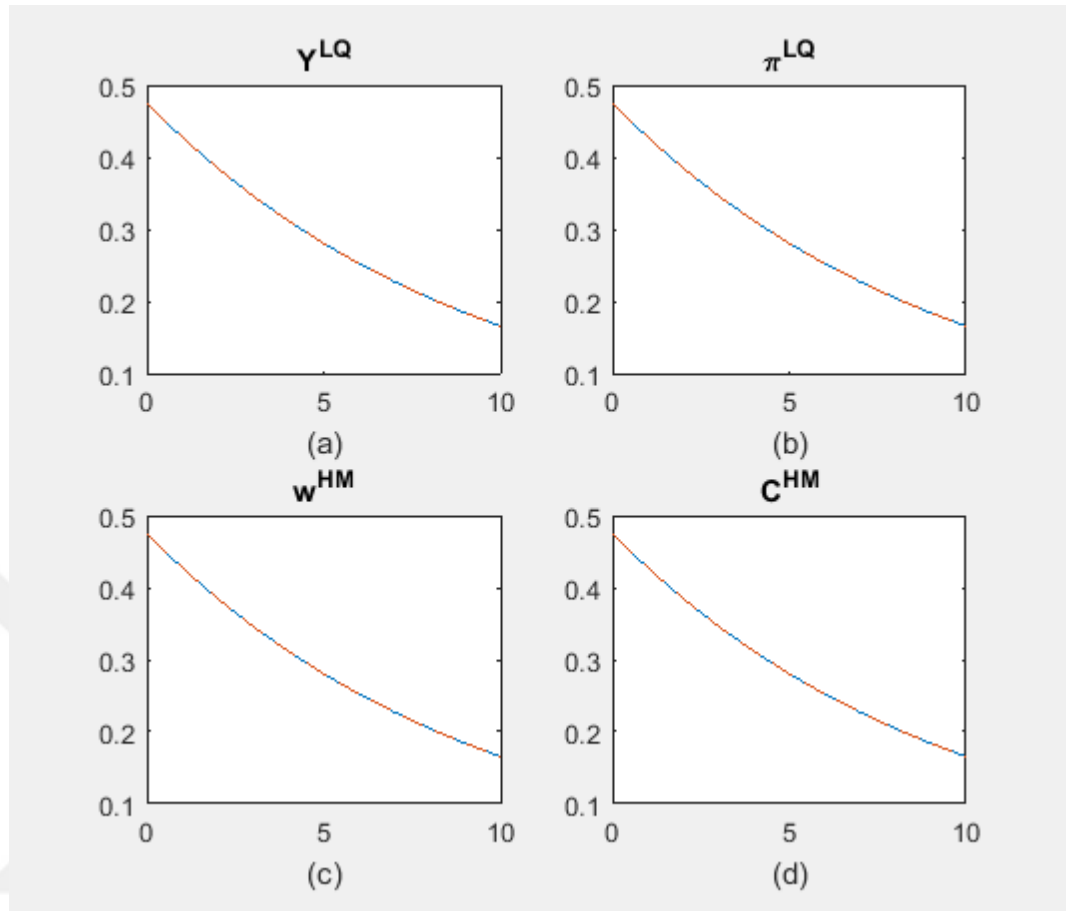


Figure 4.9 The effect of public investment shock on low-quality firms and hand-to-mouth households under Alternative Calibration - 2

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

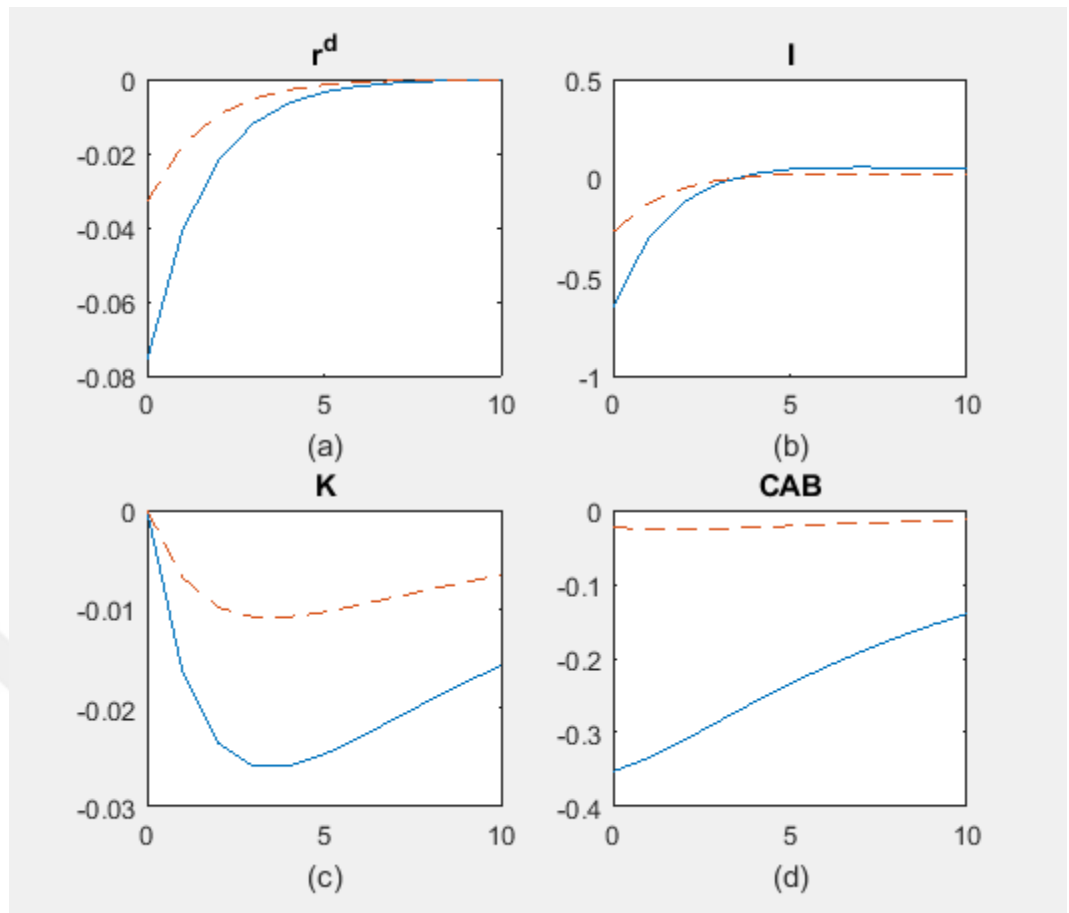


Figure 4.10 The effect of public investment shock on private sector and current account balance under Alternative Calibration - 2

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

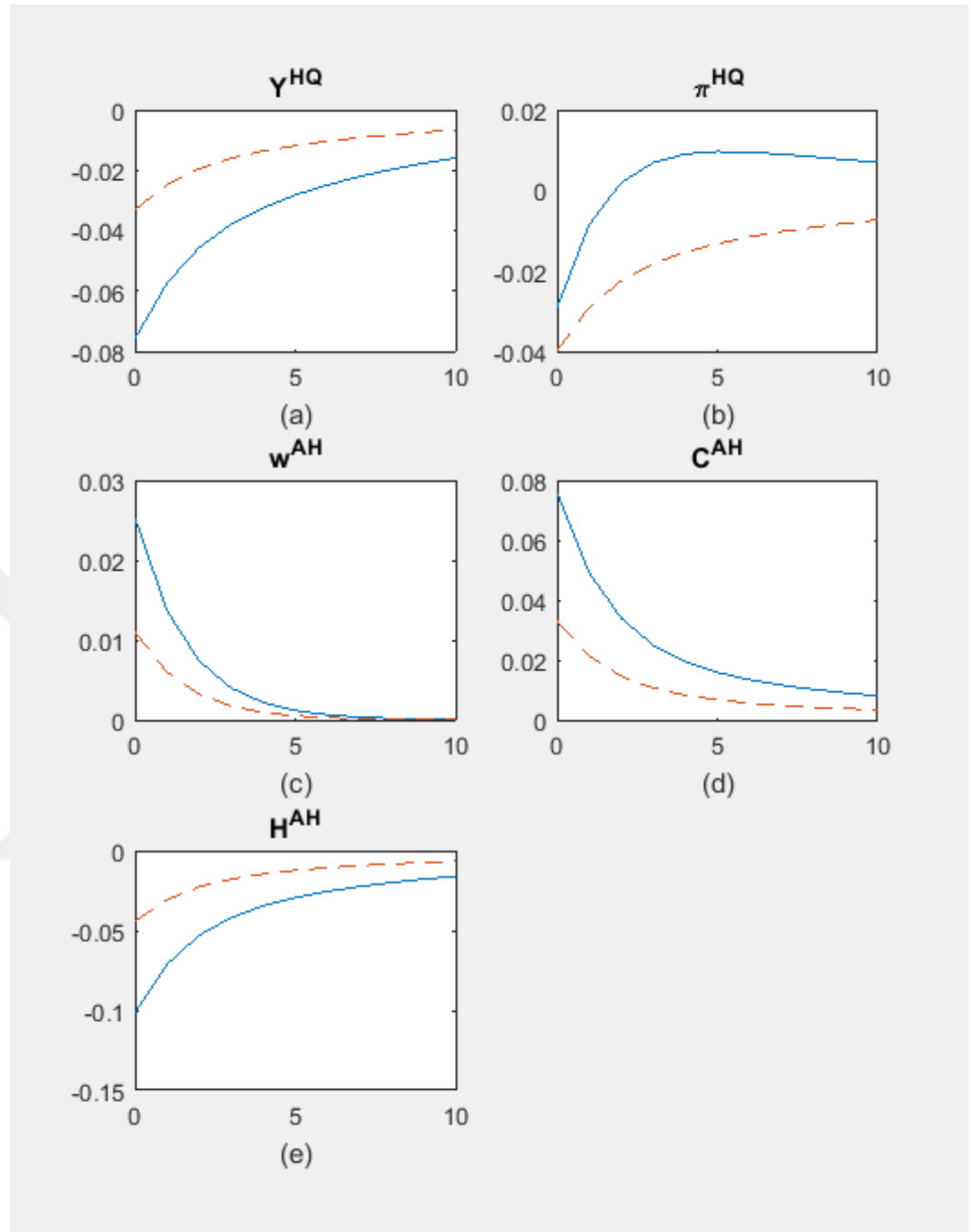


Figure 4.11 The effect of public investment shock on high-quality firms and asset holders under Alternative Calibration - 2

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

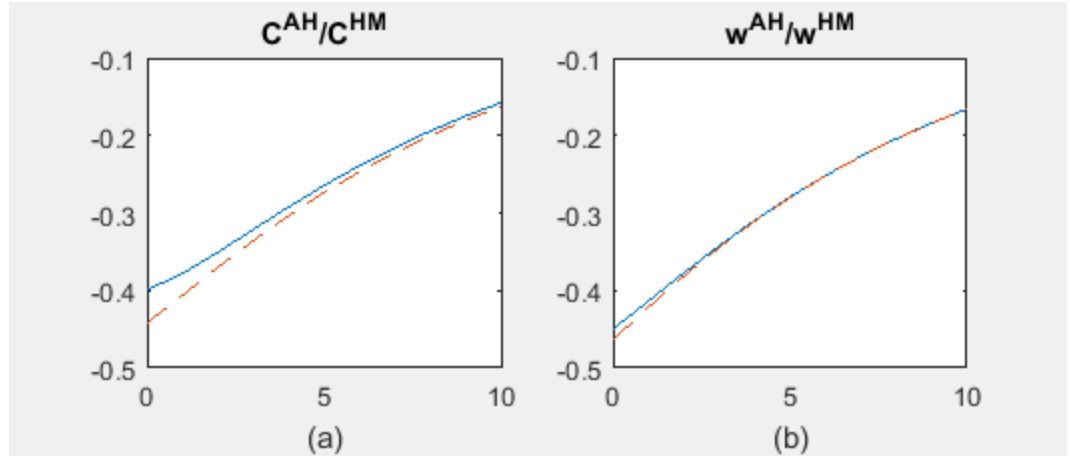


Figure 4.12 The effect of public investment shock on income distribution under Alternative Calibration - 2

Notes: *x*-axis denotes time in quarters while *y*-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.

The decrease in $\overline{Y^{LQ}}/\overline{Y^{HQ}}$ leads to lower ratios of increases in the wage and consumption of asset holders, compared to the respective ratios of increase under benchmark calibration. The wage inequality improves in a slightly higher rate under this calibration. Therefore, in an environment where $\overline{Y^{LQ}}/\overline{Y^{HQ}}$ is lower, the improving effect of government investment shock on income inequality will be stronger.

In Alternative Calibration - 3, t^a is set as 0.03, instead of 0.05. Numerical results of selected variables are given in following Table 4.5.

Table 4.5 Selected numerical results under Alternative Calibration - 3

Selected Numerical Results	
$\overline{CAB}/\overline{Y}$	0.1256
$\overline{G^i}/\overline{Y}$	0.0663
$\overline{I}/\overline{Y}$	0.1247
r^d	0.0401
t_w	0.2203

When the tax rate on asset income is decreased, the steady-state value of the current account surplus decreases. Government expenditure and investment in total output increase. Steady-state value of interest rate decreases and tax rate on wage income also rises.

As seen in Figure 4.13, this alternative calibration does not lead to any change in low-quality firms and hand-to-mouth households. The interest rate decreases more (see Panel a in Figure 4.10), leading to a lower decrease in capital and investment. The decrease in interest rates result in substitution and income effects. The financial income of asset holders decreases so they are inclined to consume less (income effect). On the other hand, the price of consuming in the present time with respect to future decreases and asset holders are inclined to consume more (substitution effect). The asset holder increases their consumption in a higher ratio than the benchmark model, although the interest rate decreases more. The substitution effect surpasses.

Current account surplus decreases more, compared to the benchmark calibration. Y^{HQ} and C^{AH} do not change very much, I decreases less (see Panel a and d in Figure 4.15), Y^{LQ} and C^{HM} stay constant. All these imply a lower decrease in current account surplus.

Profit of high quality firms decreased in a higher ratio than the benchmark model. Among the variables which affect the profit, the impulse response of K changes in a substantial ratio (see Panel c in Figure 4.14). The higher decrease in profits is linked to that change. The decrease in t_a results in a very slight improvement in income distribution (see Figure 4.16).

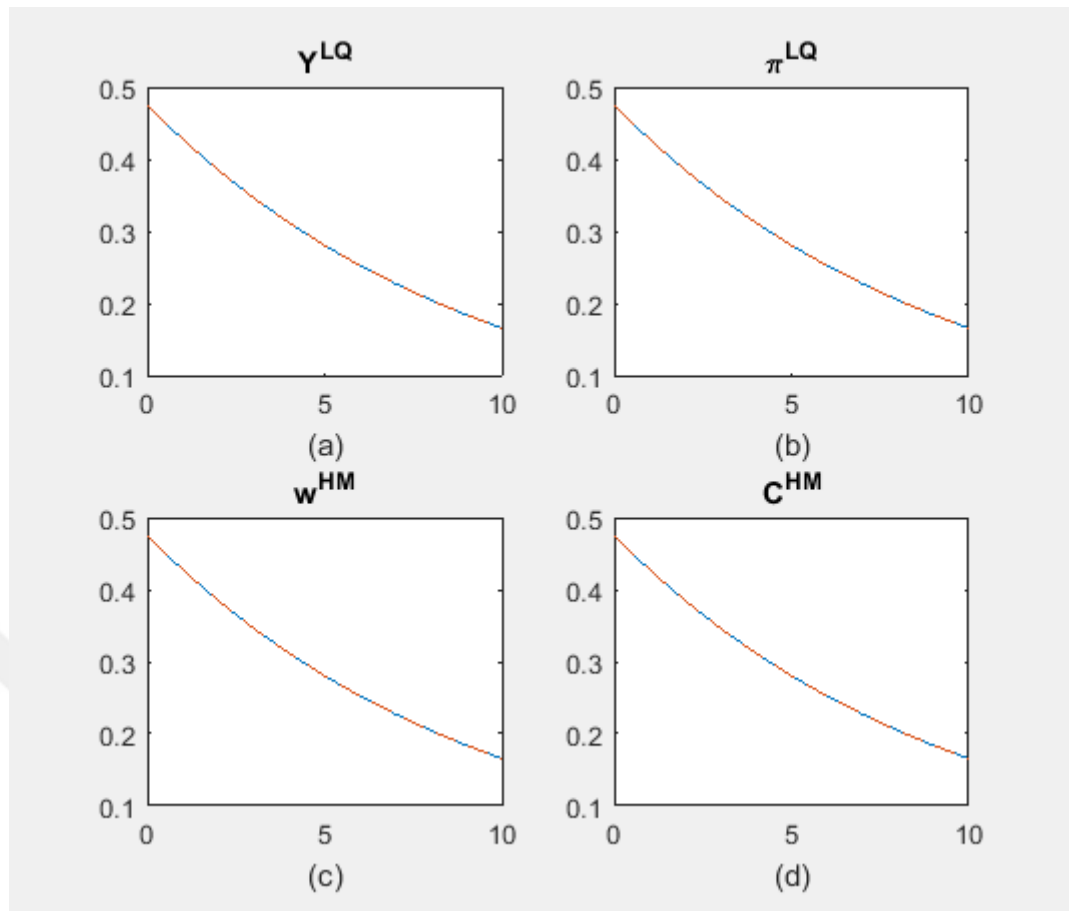


Figure 4.13 The effect of public investment shock on low-quality firms and hand-to-mouth households under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

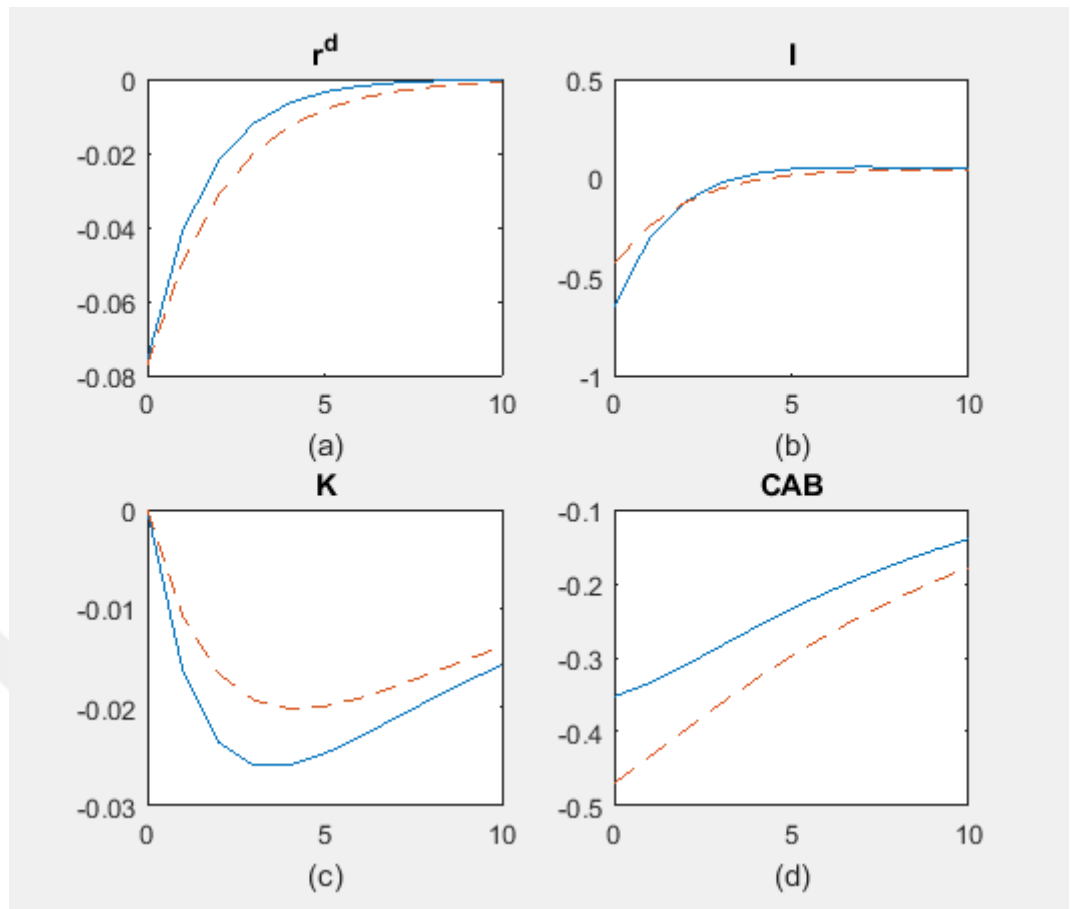


Figure 4.14 The effect of public investment shock on private sector and current account balance under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

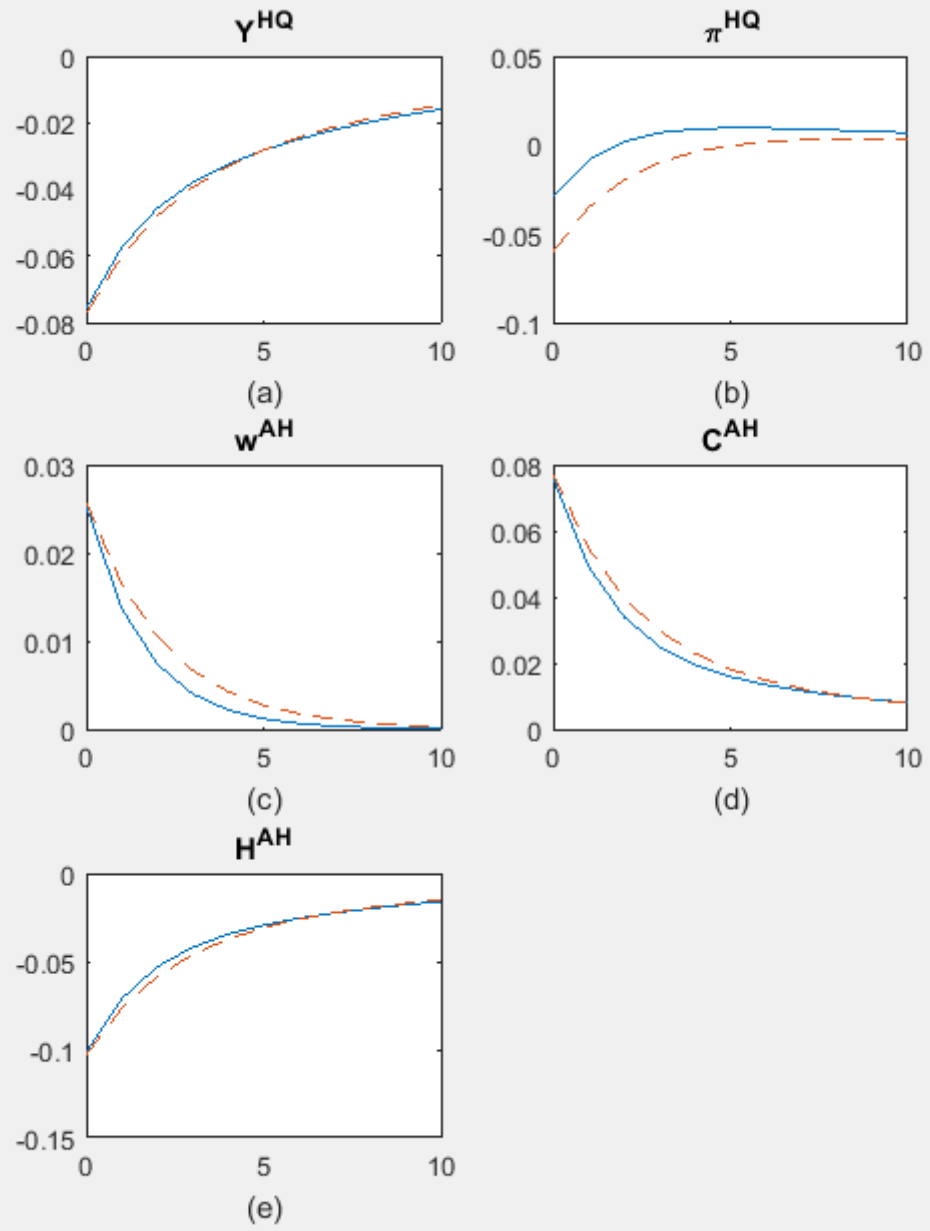


Figure 4.15 The effect of public investment shock on high-quality firms and asset holders under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

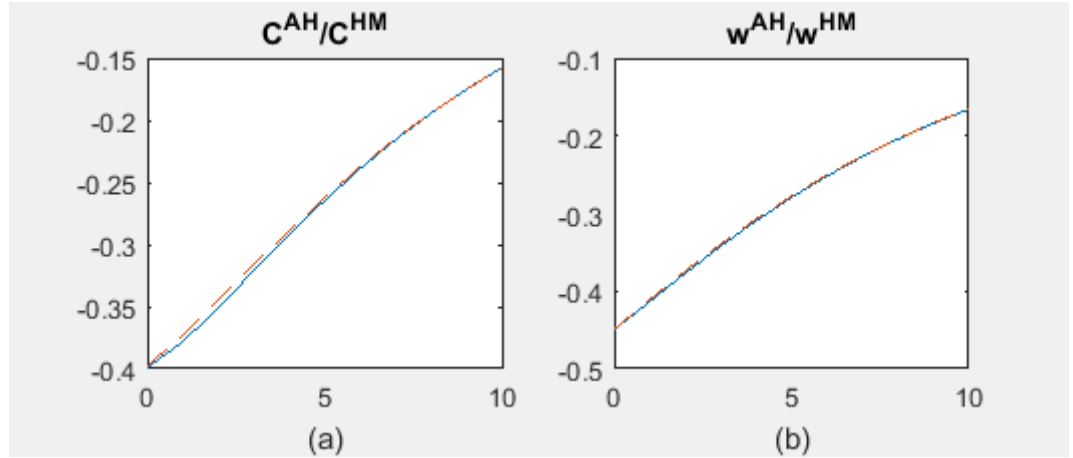


Figure 4.16 The effect of public investment shock on income distribution under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

4.5. Conclusion

The present chapter constructs a theoretical small open economy model with two types of households and firms. The first type of households has a positive saving propensity, while the second type consumes all disposable income at each period. This assumption allows for the differentiation of the income sources for different households. Specifically, the first type of households has both labour and capital income whereas the second type has only labour income. As such the model is capable of taking into account the negative effect of public debt on income distribution. Indeed, excessive public debt may lead to a rise in the interest rate which increases the income of asset holders. On the other hand, the debt-financed public spending is likely to improve income distribution. For example, social transfers or public spending on infrastructure which enhances employment especially for non-qualified labour may have a positive impact on income distribution. This aspect is introduced in the present chapter by assuming that public investment serves as capital for low-quality firms, which employ hand-to-mouth households. This implies that public capital increases labour productivity in the low-quality sector and increases thereby the wages of hand-to-mouth households as implied by the profit maximization condition.

This setup is used to analyse the effects of a debt-financed public investment expenditure shock on different types of incomes of different types of households. The results show that an increase in government expenditure for increasing infrastructural investment increases the wage income and decreases the dividend income and improves thereby income distribution. Put differently, this type of policy decreases income inequality. It leads to current account deterioration, but increases output. The negative aspect of government expenditure is its negative effect on private saving and investment; and the private capital stock as a result. This type of government expenditure leads to an increase in consumption levels of both types of households; but it has a higher positive impact on hand-to-mouth households. This is parallel with its effects on wages. In this sense, it can be said that government expenditures decreases the income inequality and supports hand-to-mouth households through wages. In addition, government investment expenditure has a positive effect on output as a whole.

The sensitivity analysis indicates that assumptions of the setup are well-constructed. The results of alternative calibrations are not qualitatively different from the results of the benchmark calibration. The directions of variables' movement do not change. The numerical changes in calibrated values lead only quantitative changes in steady-state values and in the impulse responses of variables.

The present chapter contributes to the literature in several ways. First, it introduces optimizing agents (households and firms), which allows shedding light on the interaction between public and private sector. Second, in contrast to the majority of the literature, the present paper assumes an open economy setup which allows considering not only wealth transfers within the country, but also those among the countries. Finally, in contrast to the literature, the present paper considers the effect of public investment policies instead of an increase in public consumption.

The setup considered in this chapter can be extended in several ways. First, it is possible to follow Hein (2007) to introduce nominal prices along with imperfect competition in order to capture the effect of price-setting behaviour on profits and

therefore dividends. The government expenditures are limited to infrastructural expenditures in this model. This limitation can be omitted. Finally, the modelled economy is an open economy, but only the government can exchange with the external world. The model can be extended to include the foreign capital. The last two suggestions are applied in Chapter 5.



5. A SMALL OPEN ECONOMY WITH COUNTRY INTEREST RISK PREMIUM

5.1. Introduction

Real Business Cycle (RBC) analysis is principally used to investigate economic growth; however other phenomena including consumption, investment etc. can also be dynamically traced in real business cycle theory (King et al. 1988a).

The vast of literature on RBC model focuses on technological shocks and its impact on key macroeconomic variables such as GDP. The technological shocks are considered as the main driving force of economic fluctuations in the neoclassical setup. On the other hand, as underlined in King et al. (1988a), the shocks can also stem from sources other than technology. The shock can be related to preferences, government policies or terms of trade.

King et al. (1988b) introduce government spending and taxation, and agent heterogeneity to the neoclassical RBS model. According to the model:

- A lump-sum transfer financed by taxation in a static economy does not lead to any change in the production possibilities of the economy, but it leads to changes in labour-leisure choice of agents and drives the economy away from the optimal allocation.
- Tax-financed government expenditure and lump-sum transfers in an intertemporal model do not prevent the model to reach to a steady state, if stability conditions are met.

King et al. (1988b) add agent heterogeneity to their basic benchmark model, in another part of their study. Agents are assumed to differ with respect to their labour

skills, preferences and wealth and they are classified in J number of groups. Each group is weighted according to their wealth. The differences in labour skills and wealth do not result in the steady-state dynamics of consumption and labour supply, but differences in preferences result in changes in steady state dynamics via labour supply.

Generally, RBC models consider a closed economy. The study by Schmitt-Grohé and Uribe (2003) is an one exception of this; the study focuses on open economy RBC models and the methods to induce stationarity to the model. The alternative calibrations suggested by the authors include endogenous discount factor, debt-elastic risk premium, capital adjustment cost and complete asset markets and they measure the changes to the variables in response to a technology shock. These models differ from the present study in the sense that they do not include a government sector or government debt; but the method to include risk premium dependent on foreign debt is adopted in the present study. The present paper modifies the "DEIR" model by Schmitt-Grohé and Uribe (2003). Schmitt-Grohé and Uribe (2003) also compare their models with the real data, using second moments analysis; which is also used in the present study.

While Schmitt-Grohé and Uribe (2003) do not concentrate on wealth effect of technology shock in such environment, Özbilgin (2017) concentrated on the welfare effect of closing small open economies, with reference to the methods given in Schmitt-Grohé & Uribe (2003). The author compared mainly DEIR and PAC model in the mentioned paper; which are debt-elastic interest rate method and portfolio adjustment cost method, respectively.

The real business cycle model is based on the assumption that rational individuals respond productivity disturbances by smoothing consumption via adjusting their saving and investment and by changing the labour supply with respect to relative price of leisure. The real business cycle can be applied to a small open economy (Mendoza, 1991).

In majority of studies about general equilibrium, the households, or individuals, are taken as representative, fully-rational consumers with totally unique characteristics. In some model, the households or individuals are grouped with respect to their saving habits. They are grouped as workers and capitalists, savers and non-savers etc. In some models with one representative type of households, the households are assumed to have both wage income and capital income (e.g. Flodén, 2001).

Grouping households as workers and capitalists and analysing income distribution with respect to these groups is a path of study. In some models, workers are assumed to save some of their income and therefore, they have a wage income and a capital income. In these models (Palley, 2013a; Pasinetti, 1962, 1989) capitalists' propensity to save is higher than workers' propensity to save. In some models, saving propensity of workers is zero; all saving of the economy comes from the rentiers' class (Hein, 2018).

Saving and consumption behaviour of consumers can be studied with respect to Euler equation approach, which assumes a fully rational and forward-looking representative consumer. After underlining the importance of this approach, Campbell and Mankiw (1989) proposed a model including two types of consumers: permanent income consumers and current income consumers. In this model, the ratio of permanent income consumers and current income consumers to the total population are not considered; but, the fraction of income which falls to the share of permanent income consumers is defined. This model focuses on the estimation of consumption with respect to income.

Mankiw (2000) groups households into two as spenders and savers and focuses on the ability to smooth consumption. Accordingly, spenders do not have any wealth and they cannot smooth consumption; so, consumption of these households is simply a function of their income. The author supports this idea by giving evidence of US population that majority of people have zero or negative wealth and they have limited access to credit system due to their weak financial position. Savers, on the

other hand, have wealth and they smooth consumption not only from year to year, but also among generations.

Public debt has been an important issue for Turkish economy. When Turkey experienced the crisis of 2000-2001, the public debt was a source of distortion over commodity and asset markets due to high interest rates on this debt. Decreasing the government debt was considered essential to give a signal of confidence to domestic and foreign markets, so stabilisation measures were taken under the supervision of IMF (Voyvoda & Yeldan, 2005).

Yakut and Voyvoda (2017) focus on the effects of public sector policies on income distribution, considering internal migration in as an important factor in Turkey. The study constructs a small open economy framework with rich agent heterogeneity. Households are classified in 7 groups with respect to their income sources and their utility functions are designed with respect to whether they save or not. The calibration of variables are done using both the macro data about Turkey and micro data including Household Labour Force Survey (HLFS) and Household Budget Survey (HBS) published by TURKSTAT. Firms, on the other hand, are represented by 11 firms, each operating in different sector.

The present chapter builds on the existing literature, using RBC setup in order to analyse the effect of public debt on income distribution. Different from the above-mentioned models, the present model includes a temporary shock on public spending and explores its effect on key macroeconomic variables such as consumption, wages and income. The households are grouped as asset holders and hand-to-mouth households; asset holders are the holders of government bonds. Government is assumed to finance its consumption and debt with taxes and domestic debt, only. It is found that interest payment on domestic bonds issues by government deteriorates the income distribution.

The chapter is organised in the following way: Section 5.2 presents the model while Section 5.3 provide the necessary information about how the values are

calibrated and results of the model, including impulse responses. In Section 5.4, the related data from Turkish economy are introduced; some portions of the data are illustrated and the second moments are given. In Section 5.5, a sensitivity analysis of the model via three alternative calibrations is given. Section 5.6 concludes.

5.2. The Setup

In the previous chapter, a theoretical model was designed to analyse the effect of government expenditure on income distribution. The model was specified in such a way that government expenditures were used as infrastructure of one kind of firms. In order to measure the impact of investment expenditures of the government, the firms were defined in two groups, with different levels of production technology. Asset-holder households were assumed to have financial income from one type of firms.

In this chapter, this assumption that government expenditures are only used in production is left. The expenditures are financed from asset-holder households' savings. Additionally, the foreign investment is considered; therefore current account and budgetary account are split from each other. An endogenous debt position of the government is added to the model and a risk premium, dependent on this debt position, is introduced.

5.2.1. Households

As in the previous chapter, agent heterogeneity is introduced by assuming two groups of households with different saving behaviour. The asset holder households save some portion of their earnings, and obtain thereby, an interest income whereas hand-to-mouth households do not save, which implies that the wage is their only source of income. Since the total population is normalized to 1, the share of hand-to-mouth households is given by η while $1-\eta$ represents the share of asset holders.

5.2.1.1. Asset Holders

The preferences of a typical asset-holder j is given by the following utility function which is standard in neoclassical models (King et al., 1988a):

$$E_t = \sum_{s=t}^{\infty} \beta^{s-t} C(j)_s^{AH^\alpha} (1 - H(j)_s^{AH})^{1-\alpha} \quad (5.1)$$

In Eq. (5.1), C^{AH} is the amount of consumption by an asset holder household, H^{AH} is the labour effort of an asset holder, measured by the number of hours worked, $0 < \beta < 1$ is the subjective discount factor and $0 < \alpha < 1$ is the elasticity of demand for consumption for an asset holder.

The parameter β is defined as a constant discount factor, between 0 and 1. Several models assume an endogenous discount factor in order to guarantee a stationary steady-state in open-economy real-business-cycle models (Kim & Kose, 2003). Choosing β as a time-dependent variable is a method to induce stationarity to the open economy RBC model. In this study, the stationarity is induced to the model by defining a risk premium on interest rate, dependent on the debt position of the country. So, constant β is preferred.

Asset holders lend to government by buying one-period real public bonds denoted by D paying an interest rate denoted by r^d . Moreover, the asset holder supplies labour and receives wages net of taxes and consumes. Thus, the budget constraint of a typical asset holder can be written as follows where the index j is dropped for ease of notation since all asset holders are identical:

$$(1 - t_w)w_t H_t^{AH} + (1 + r_t^d)D_t - C_t^{AH} = D_{t+1} \quad (5.2)$$

In Eq. (5.2) t_w is the rate of tax on wage income and w is the hourly wage. Moreover, D_{t+1} represents the government bond held during period t and arriving at maturity at the beginning of period $t+1$. In contrast to the previous chapter, it is assumed that public bonds are held only by the residents. This preference is similar

to the model by D'Erasmus and Mendoza (2016), where fraction γ of households with less initial government bond holdings and $(1-\gamma)$ of households with high initial government bond holdings are included; government finance its consumption and debt by collecting taxes and collecting money from domestic agents.

The asset holder maximizes utility given in Eq. (5.1) with respect to C_t^{AH}, H_t^{AH} and D_{t+1} under the budget constraint given in Eq. (5.2). The first order conditions are given below, where λ is the Lagrange multiplier associated with the budget constraint:

$$\lambda_t = -\alpha C_t^{AH\alpha-1} (1-H_t^{AH})^{1-\alpha} \quad (5.3)$$

$$\lambda_t = \frac{-(1-\alpha)C_t^{AH\alpha} (1-H_t^{AH})^{-\alpha}}{(1-t_w)w_t} \quad (5.4)$$

$$\lambda_t = \lambda_{t+1} r_{t+1}^d \beta \quad (5.5)$$

5.2.1.2. Hand-to-Mouth Households

The second group of households are hand-to-mouth households. The share of hand-to-mouth households in total population is given by η . Their utility function is similar to that of asset-holder households; it increases with consumption (C^{HM}) and decreases with the ratio of hours worked within a 24-hour day (H^{HM}). So, the utility function is written in a Cobb-Douglas form as follows:

$$u_t = C_t^{HM^\theta} (1-H_t^{HM})^{1-\theta} \quad (5.6)$$

where $0 < \theta < 1$ denotes the elasticity of demand for consumption for a hand-to-mouth household.

These households do not have access to the asset market implying that they do not have any savings. Therefore, they simply consume all of their disposable income at each period. Thus, the consumption of a typical hand-to-mouth household can be written as below:

$$C_t^{HM} = (1-t_w)w_t H_t^{HM} \quad (5.7)$$

where w_t is the hourly wage and t_w is the rate of tax on wage income. In contrast to the previous chapter, it is assumed that hourly wage is the same for asset holder and hand-to-mouth households. This assumption is related to the fact that the present chapter eliminates firm heterogeneity assumption of the previous chapter. This aspect will be detailed in the next section.

Assuming that hand-to-mouth households have the same preferences as the asset holders, utility maximization under the budget constraint given in Eq. (5.7) yields the following labour supply decision for the hand-to-mouth households:

$$H_t^{HM} = \theta \quad (5.8)$$

Eq. (5.8) equates the marginal utility of consumption to the marginal utility of leisure for a hand-to-mouth household.

5.2.2. Firms

As already mentioned, the present chapter assumes that there is only one type of firm. Each firm is assumed to operate in a perfectly competitive environment. The representative firm is assumed to rent foreign capital F from abroad on which it pays an interest r^f . Thus, the production function can be given as follows:

$$Y_t = A_t H_t^\delta F_t^{1-\delta} \quad (5.9)$$

where H denotes the total hours of labour hired by the firm and δ is share of labour in total production. Since the focus is on fiscal policy instead of technology shocks, the present setup normalizes the total factor productivity A to 1.

The assumption of foreign capital in the production function is somewhat unusual in the RBC literature. Although financial capital is assumed to be mobile at the international level in open economy versions of RBC models, it is related solely to the consumption smoothing purposes of households without any relation with the firms. In this chapter, foreign capital enters the production function implying that any incoming capital from abroad contributes to the domestic country's production level

and hence to its GDP. This assumption is introduced in order to capture the dependence of the Turkish firms on foreign capital. Indeed, the output growth of the Turkish economy increases in times of high capital inflow. Turkey receives foreign capital especially through the channel of portfolio investment and the loans received by the Turkish banks from foreign counterparts registered under “Other Investment” section in the balance of payments. While the capital inflow in the form of portfolio investment benefits to a limited number of firms traded in the Istanbul Stock market, the capital inflow through banks is distributed among all firms in the form of commercial loans. Therefore, in this chapter, it is assumed that all firms receive foreign capital equally, which eliminates the firm heterogeneity assumption of the previous chapter.

For simplification purposes, the present chapter abstracts from physical capital and introduces foreign capital instead. Put differently, the only input other than labour is the foreign capital F , which is repaid with its interest at the end of each period. This implies that the foreign capital indicates the borrowings of firms from abroad rather than a physical capital which leads to an accumulation through investment. Therefore, in the present setup, investment is also excluded in contrast to the previous chapter.

The profit function of the representative firm is given as:

$$\pi_t = Y_t - w_t H_t - (1 + r_t^f) F_t \quad (5.10)$$

Profit maximization under Eq. (5.10) implies the following first order conditions:

$$F_t = \frac{Y_t}{(1 + r_t^f)} (1 - \delta) \quad (5.11)$$

$$H_t = \frac{Y_t}{w_t} \delta \quad (5.12)$$

Eq. (5.11) is the foreign capital demand which equates the marginal productivity of foreign capital to its cost and Eq. (5.12) is the labour demand which equates the marginal productivity of labour to the wage. According to Eq. (5.11), the demand for foreign capital decreases when the cost of one unit of foreign capital increases. Indeed, if the unit cost of foreign capital decreases, the demand for it increases. Similarly, Eq. (5.12) implies that the demand for labour increases if the unit cost of labour decreases; and vice versa.

In contrast to Jahan-Parvar et al. (2013) where production depends on labour and physical capital, the present setup replaces physical capital with foreign financial capital. While the role of foreign capital in the production process is similar to physical capital, it is different from the latter in the sense that it does not lead to capital accumulation.

5.2.3. Government

Government expenditures are financed by labour income taxes and by public debt. Generally, public debt is excluded especially in case of household homogeneity since identical household assumption leads to the Ricardian equivalence. In such a case, debt-financed fiscal policy leads to the same results as tax-financed fiscal policy. Therefore, there is no need to introduce public debt into the model. Then, taxes become the only source for financing public spending. These taxes can be lump-sum as in Borenstein and Elkayam (2014), Correia et al. (1995) and Jahan-Parvar et al. (2013). In contrast, lump-sum taxes are considered as more efficient compared to proportional taxes, since they do not distort consumer and producer behaviour. However, lump-sum taxes are unrealistic. Therefore the present chapter assumes proportional taxes in contrast to the abovementioned papers. Specifically, it is assumed that government expenditures are financed by labour income tax along with public debt. Hence, the intertemporal government budget constraint can be written as follows:

$$D_{t+1} = G_t + (1 + r_t^d)D_t - t_w w_{t+1} H_{t+1} \quad (5.13)$$

The government's budget constraint is a standard one: government expenditure (G) and payment of debt (D) with its interest are the expenses whereas taxes on wages (wHt_w) and new debt (D_{t+1}) are the revenues.

The interest rate of government bonds is assumed to include an external debt-elastic risk premium as in Schmitt-Grohé & Uribe (2003) and Araújo (2012). Specifically, the interest rate on public bonds deviates from the world interest rate R^* (considered as exogenous due to the small open economy assumption) as the current public debt-to-GDP ratio deviates from its steady-state level denoted by $\bar{D}/\bar{Y}$. Thus, the rate of return for government bonds, r^d , can be defined as follows:

$$r_{t+1}^d = R^* + \psi \left[e^{\frac{D_{t+1}}{Y^{t+1}} - \frac{\bar{D}}{\bar{Y}}} - 1 \right] \quad (5.14)$$

where ψ is the constant parameter which implies the sensitivity of interest rate to the country debt position.

Risk premium on interest rate is added to the standard open economy RBC model to induce stationarity. In such a model, the rate of return of bonds is determined abroad; this determination is not included in the model. This assumption gives unstationarity to the model. Introducing a risk premium dependent on the debt position of the country is among the methods suggested by Schmitt-Grohé and Uribe (2003). This assumption is appropriate for Turkish economy, too. When the data on debt-to-GDP ratio of Turkish economy and interest rate 10-years-maturity government bond are considered, it is found that they have a correlation of 56% for the period 2007-2011 (from own calculations based on data from EUROSTAT, 2018 and OECD, 2018a).

In Eq. (5.14) the debt-to-GDP ratio is taken in aggregate terms. Therefore, the deviation is calculated as the deviation of debt-to-output ratio from the steady-state level. In this way, if the debt-to-output ratio is 1 point above the desired level, the interest rate is ψ times 0.0101 percentage points above the world interest rate, as $e^{0.01}$ equals to 1.0101.

It is assumed that the log of public spending G_t follows a standard AR(1) process:

$$\ln G_{t+1} = \rho \ln G_t + \varepsilon_{t+1} \quad (5.15)$$

with a one-time i.i.d. shock $N(0, \sigma^2)$ with error term ε_t and ρ is the parameter of consistency of this shock.

5.2.4. The Current Account and the General Equilibrium

The current account equation is obtained from the country resource constraint (goods market clearing condition) which is obtained by aggregating the household budget constraint over all types of households and combining the result with the government's budget constraint. As the model assumes an open economy, a current account equation is needed to include foreign assets. Thus, the current account can be written as follows:

$$F_{t+1} - F_t = r_t^f F_t + C_t + G_t - Y_t \quad (5.16)$$

Total hours worked by these two groups of households, H , and total consumption are calculated as in the following two equations:

$$H_t = (1 - \gamma)H_t^{AH} + \gamma H_t^{HM} \quad (5.17)$$

$$C_t = (1 - \gamma)C_t^{AH} + \gamma C_t^{HM} \quad (5.18)$$

The general equilibrium is given by the sequences for the choice variables $\{C_t^{AH}, C_t^{HM}, H_t^{AH}, H_t^{HM}, \lambda_t, Y_t, F_t, D_{t+1}\}_{t=0}^{\infty}$, the prices (expressed in real terms) $\{w_t, r_t^f, r_{t+1}^d\}_{t=0}^{\infty}$ and the policy instruments $\{G_t^i\}_{t=0}^{\infty}$ satisfying the following equilibrium conditions:

- i. Labour supply (Eq. 5.4 and Eq. 5.8) equals labour demand (Eq. 5.12)
- ii. Good market clears, implying that output given by the production function (Eq. 5.9) equals demand, expressed as the sum of world

public and private consumption along with investment given the initial conditions for F_0 and G_0 .

The model is solved under the rational expectations assumption according to the solution method given by Schmitt-Grohé and Uribe (2003). This solution method gives the response of each variable to the policy shock measured in terms of percentage deviation from the steady-state. The steady-state is defined as the initial state of the economy where the growth rate of any variable is zero. The equations used in the model are given in Appendix D. The steady-state values of the variables are also given in the Appendix E.

5.3. Calibration and Results

Since this is a dynamic setup with infinite number of periods, it is not possible to obtain analytical results. Therefore, the theoretical model, presented in the previous section, will be solved numerically. This requires assigning values to the parameters of the model. This section discusses the values assigned to the calibrated parameters.

5.3.1. Calibration

The parameter δ , which gives the share of labour income in GDP, is calibrated for Turkey using the following method: the GDP income approach data from OECD website for 2000-2017 are used (OECD, 2018a). The value given for the "compensation of employees" is divided by total GDP and the average for the period 2007-2017 is calculated. This yields an average of 27.23%. Therefore, δ is taken as 27.23%.

The parameter η represents the share of households who do not save. This value is calibrated using the data included in Survey on Income and Living Conditions, which is annually carried out by TURKSTAT (2018b). This survey includes a question on the interest dividend income of the household. According to

the panel data of 2008-2011 (surveys published in this period covers 2007-2011), 9967 over 27833 households reported some positive amount of revenue from securities, which corresponds to 35.81% of the participants. The panel data of 2012-2016 (surveys published in this period covers 2001-2015), showed that 15024 over 50882 households reported some positive amount of revenue from securities (29.53%). 2016 data is the latest available data which reports that around 31.75% of households received income from securities and 68.25% of households did not. Accordingly, the parameter η is set to 68.25%.

Traditionally, when the available time for work effort is normalized to 1, hours worked is set to 1/3 in the steady-state implying that households devote 1/3 of the day to labour effort. Since the present setup includes household heterogeneity, it would be appropriate to assume that labour supply is also heterogeneous across different types of households. Therefore the steady-state labour effort of asset holders is set to 1/3 while the labour effort of hand-to-mouth households must be calibrated according to the data. According to the data, a worker in Turkey works for 1832 hours on average per year (OECD, 2018b). If it is considered that there are 260 working days in a year, this is equivalent to 7.05 hours of work in a day. Accordingly average labour effort, H , should equal 7.05/24 in the steady-state. Given that H^{AH} is equal to 1/3, H^{HM} must be equal to 0.2753 assuming that η is 0.6825. This pins down the value of θ , which is equal to the steady-state labour effort of hand-to-mouth households.

The term R^* , which is the world interest rate in real terms, is calculated using quarterly US data between 2007 and 2017, taken from the OECD data. Following Mendoza (1991) who also takes the US interest rate as the benchmark world interest rate, R^* is calibrated as the US long-term interest rate taken from the "Long-term interest rate, per cent per annum" data (OECD, 2018a). Instead of taking a single-point value, the average value over the period from 2007-Q1 to 2017-Q4 is taken. The average value for the mentioned period is computed as 2.78%. Therefore, R^* is set to 2.78%.

The risk premium parameter ψ is calculated using Turkey and US data. For this, the long-run interest rate of Turkey is calculated using the monthly data from (EUROSTAT, 2018), under the "Government Bond Yields, 10 Year-Maturity" series. The quarterly data is obtained by taking three-month average. In order to obtain the real interest rate, quarterly inflation data from (OECD, 2018a) is subtracted from the nominal interest rate. As the data is quarterly, the R^* benchmark, interest rate of government bonds in Turkey (r^d) and annual inflation rate are divided by 4. So, the deviation from world interest rate is calculated as: (nominal interest rate on government bond - inflation rate - 0.0278)/4.

Given the Turkish long run nominal interest calculated with the above-mentioned method, Eq. (5.14) implies an average value of 0.4673 for the parameter ψ . The risk premium is nil in the steady-state implying that the country interest rate is equal to the world interest rate R^* . This pins down the subjective discount rate β as implied by the steady-state version of Eq. (5.5). Given that R^* is 0.0278, β must be 0.9730, which is a plausible value.

In the model, public debt-to-output ratio is targeted. The data for Turkey between 2007 and 2017 gives a public debt/output ratio of 37.25% on average (World Bank, 2018). So, the steady-state public debt-to-GDP ratio $\overline{D}/\overline{Y}$ is set to 37.25%. The steady-state government expenditure-to-output ratio is taken as 13.84%, which is the average value for Turkey over the period 2007-2017 (OECD, 2018a).

In Mendoza (1991), the standard deviation of the shock σ_e , and the persistency parameter ρ are determined such that "the values of parameters σ_e and ρ are set to mimic the variability and first-order serial autocorrelation of GDP" (p. 804).⁵ Here, these variables are chosen according to this method; therefore, the exact values to replicate the variance and the first-order serial auto-correlation of the Turkish GDP are found. The parameter ρ changes standard deviation and serial correlation values for Y , and σ_e affects only the standard deviation. Therefore, in order to match the

⁵ Mendoza (1991) considers the case of a technology shock.

standard deviation and serial correlation values of Turkish data, the values shown in Table 5.1 below are used.

The weight on consumption in the utility function α depends on the other parameters and steady-state values of the variables. Given the steady-state equations of the model presented in Section 5.2, the value for alpha can be computed as below:

$$\alpha = \frac{1 - G/Y - [(1 - \delta)r^f(1 + r^f)] - [\gamma(1 - t_w)H^{HM}\delta/H]}{1 - G/Y - [(1 - \delta)r^f(1 + r^f)] - [\eta(1 - t_w)H^{HM}\delta/H] + [(1 - \eta)(1 - H^{AH})(1 - t_w)\delta/H]}$$

Table 5.1 below summarizes the assigned/calibrated values of the parameters used for the numerical solution of the model. In the model, only the tax rate for hourly wages is taken into account. Moreover, the tax rate is the same for all types of households in the model although wages may differ across different types of households. In contrast, a progressive income tax system is applied in Turkey. The tax rate on income is applied as 15%, 20%, 27% and 35% depending on the amount of annual income. However, in our benchmark calibration, the tax rate on wage is depends on the parameters and national income instead of individual income. Specifically, the model yields the tax rate as below:

$$t_w = [(1 - \eta)r^d D/Y + G/Y] / \delta$$

When the calibrated values are used in the equation above a tax rate of 0.5203 is found. As no other taxes are included in our model, including tax on capital income or profits, the higher value of the tax rate on wage income is acceptable.

Table 5.1 Calibrated values in the model

Calibrated Values		
α	0.8896	Elasticity of demand for consumption in asset holder households' utility function
β	0.9730	Subjective discount factor
δ	0.2723	Output elasticity of labour (share of labour in total production)
$\overline{H^{AH}}$	0.3333	Ratio of hours of work in a day by asset holder households
θ	0.2753	Ratio of hours of work in a day by hand-to-mouth holder households (equal to elasticity of demand for consumption in hand-to-mouth households' utility function)
η	0.6825	Rate of hand-to-mouth households in total population
ψ	0.4673	Coefficient of country risk premium
ρ	0.932	Persistency of shock
σ_e	0.03105	Standard deviation of shock variable
R^*	0.0278	World interest rate
$\overline{D/Y}$	0.3725	Steady state value of government debt/output
$\overline{G/Y}$	0.1384	Steady state value of public expenditure/output
t_w	0.5203	Tax rate on hourly wages

5.3.2. Results

The model specified in Section 5.2 and Subsection 5.3.1 is solved numerically using *Matlab*. The required *Matlab* code is obtained by adopting one of the versions given in Schmitt-Grohé and Uribe (2003) to the model given in Section 5.2. The original codes of Schmitt-Grohé and Uribe (2003) are available on Martin Uribe's website (Uribe, 2018).

This section gives the responses of the key variables to a 1% temporary increase in public spending, which is financed both with taxes and public debt. The impulse responses are given through the Figures 5.1 - 5.4. As seen in these figures, the economy returns to the steady-state in about 70 periods following the shock, which implies a high persistence.

The increase in government expenditures exhibits the typical AR (1) movement. Due to the fall in total hours worked, total tax revenue increases less than the public spending, which leads to public budget deficit. As a result, public debt increases (see Panel c in Figure 5.1).

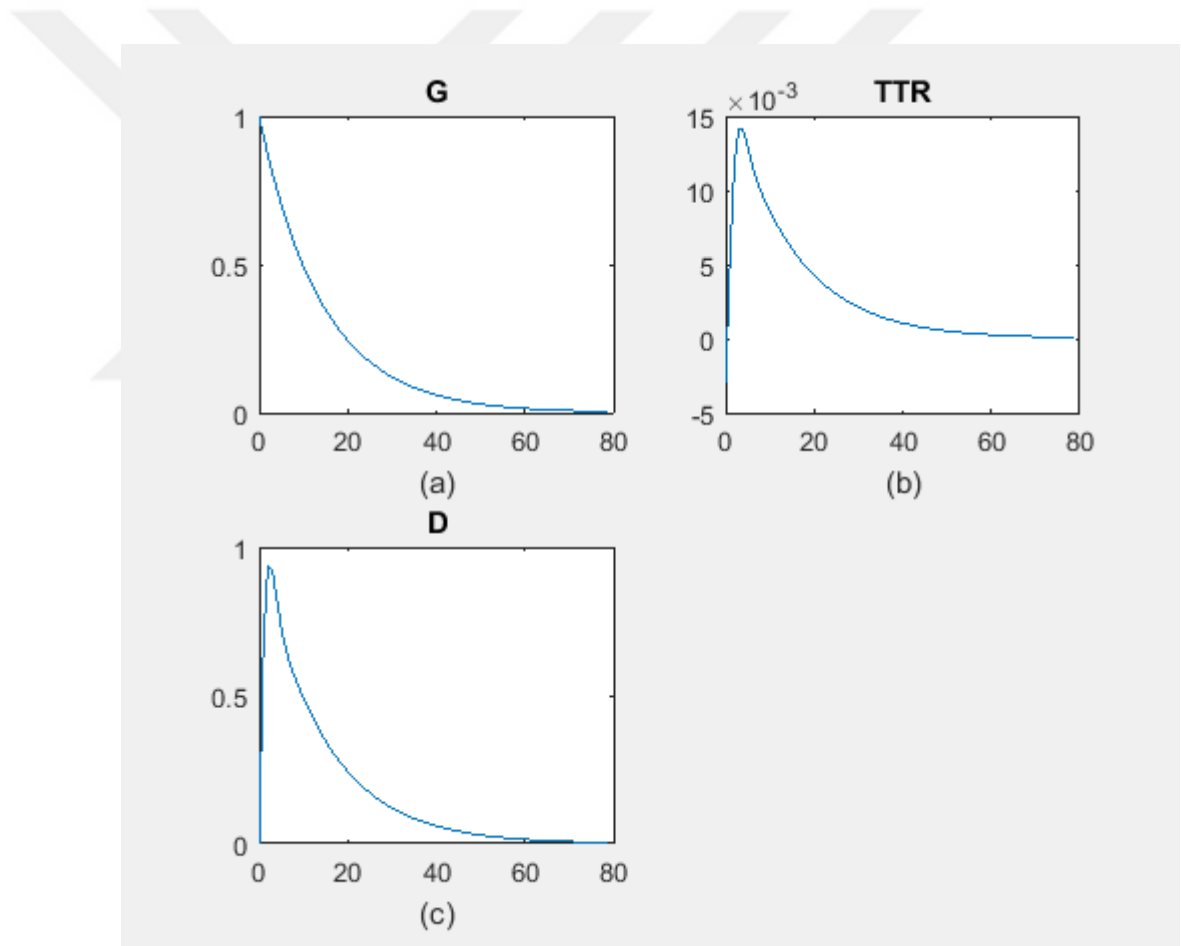


Figure 5.1 The effect of expenditure shock on total revenue and debt

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state.*

The increase in public spending stimulates demand and thereby output according to Eq. (5.16) for a given level of private consumption and net capital inflow. Consequently, firms increase labour demand as implied by Eq. (5.12). This leads to an increase in wages for a given level of labour supply. Higher wages lead to a rise the hand-to-mouth household's, income which explains the positive response of hand-to-mouth household's consumption (Eq. (5.7)). As for the asset holders, the negative wealth effect puts a downward pressure on consumption. Similarly, the rising interest rate (see Panel c in Figure 5.3) induces asset holders to reduce consumption and increase savings. On the other hand, higher wages lead to an increase in labour supply of asset holders similarly to hand-to-mouth households Eq. (5.4). This increases asset holder's wage income and raises consumption. This positive income effect dominates the negative wealth effect and the interest rate effect. As a result, asset holders respond by increasing their consumption. The positive demand effect coming from higher private consumption adds to the positive effect of public demand and hence amplifies the positive response of output (see Panel a in Figure 5.2). The rise in asset holder's consumption implies a fall in the marginal utility of consumption. The labour-leisure trade-off (Eq. (5.4)) requires a fall in the marginal utility of leisure implying that asset holders switch out of labour into leisure. This explains the reduction of hours worked by asset holders as the hours of work is constant for hand-to-mouth households (see Panel b in Figure 5.2).

As illustrated in Figure 5.3 below, the increase in public debt raises the interest rate (r^d). This can be explained by the fall in loanable funds due to the increase in private consumption whereas the demand for loanable funds increases due to the budget deficit mentioned above. Due to the risk premium assumption illustrated in Eq. (5.14), this rise of the interest rate is amplified as public debt accumulates.

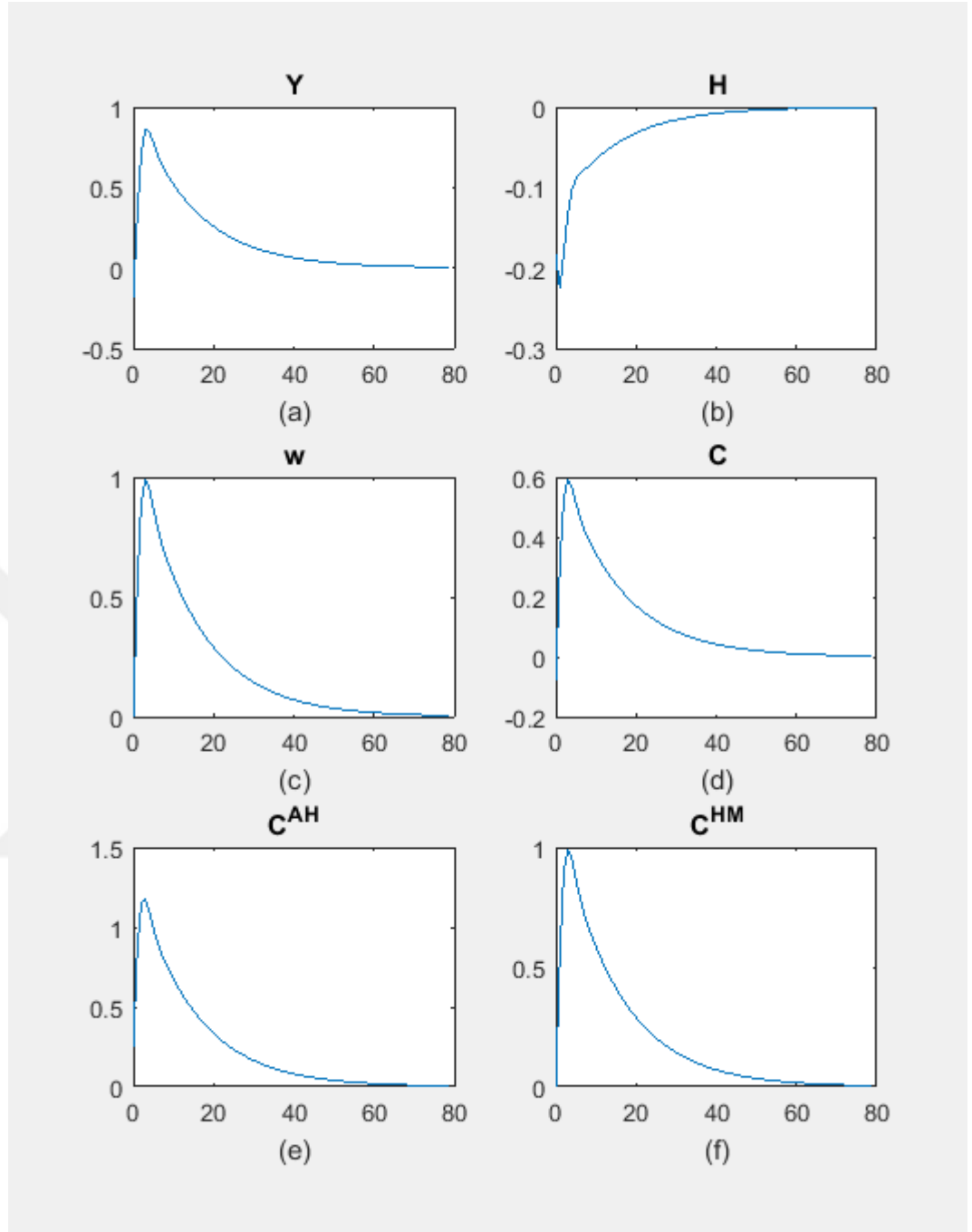


Figure 5.2 The effect of public expenditure shock on households

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state.*

The increase in total (public and private) demand exceeds the increase in output. This implies that the country runs a current account deficit which will be financed by a capital inflow (see Panel d in Figure 5.3). Higher output implies higher marginal productivity of foreign capital (see Eq. (5.9)) which increases the demand

for foreign capital. This puts an upward pressure on the rental rate of foreign capital. On the other hand, net capital inflow increases more than the demand, which puts a downward pressure on the cost of foreign capital. The latter effect dominates the former and the rental rate of foreign capital slightly falls following the fiscal expansion. Increase in wages and interest rate explains the decline in profits (see Panel b in Figure 5.3).

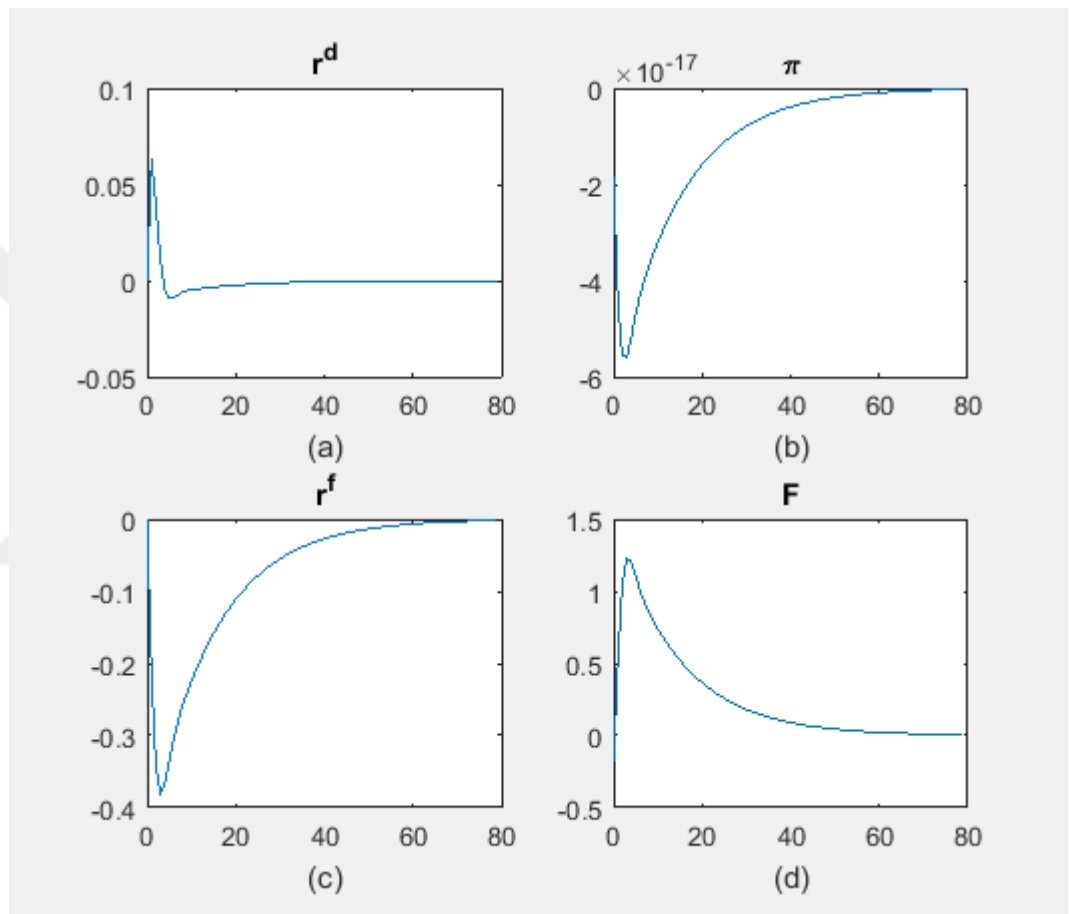


Figure 5.3 The effect of public expenditure shock on private sector

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state.*

The analysis above shows that this type of fiscal policy is effective in the sense that it increases national income. However, when the consumption of asset holders and hand-to-mouth households are compared, it is possible to see that the consumption of asset holders increases more relative to the consumption of hand-to-mouth households. Moreover, while the only source of income for hand-to-mouth

households is the wage, asset holders have both labour and capital income, both of which increase following the fiscal policy.

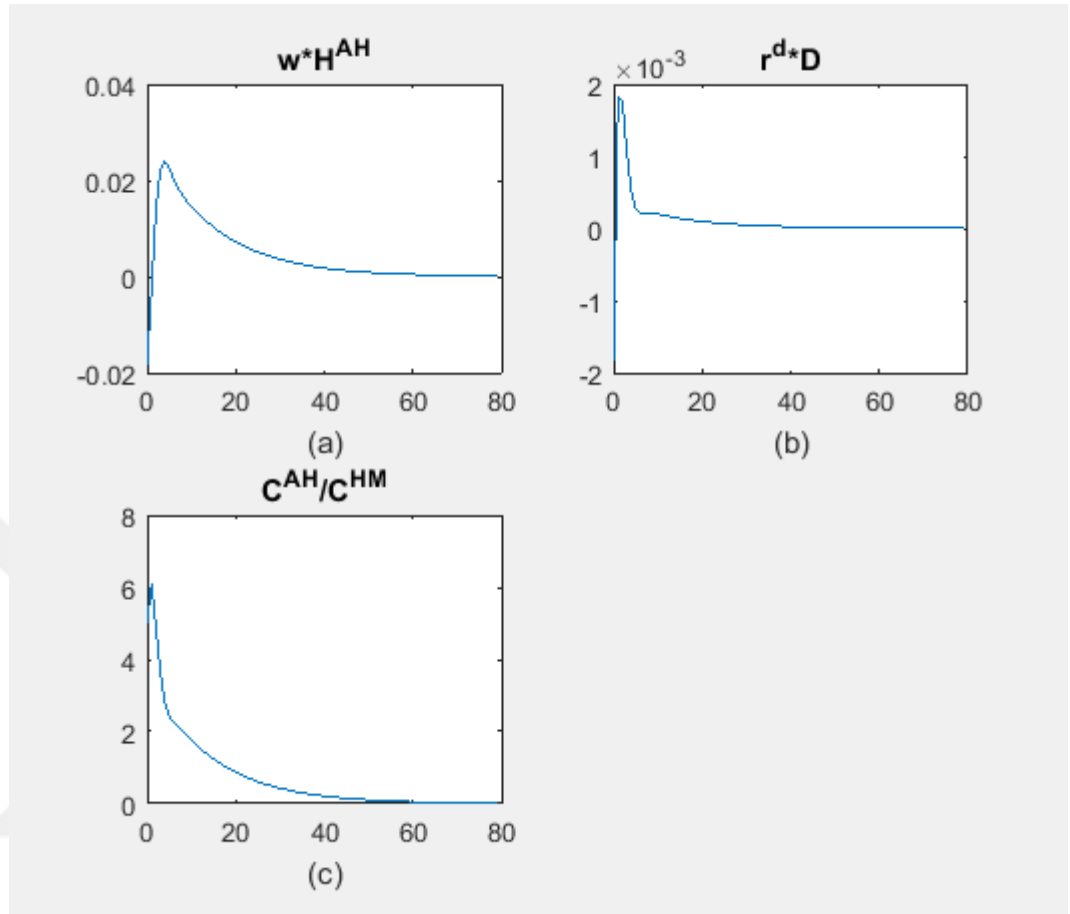


Figure 5.4 The effect of public investment expenditure shock on income distribution

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state.*

5.4. Model Evaluation

In order to see whether the theoretical model presented in Section 3 is capable of capturing the features of the Turkish economy and to measure the extent to which the theoretical model is close to real world data, the method by Schmitt-Grohé & Uribe (2003) is followed and the theoretical model is simulated to generate theoretical time series from the model for the key variables. Then the second order moments are computed, using the theoretical time series. As a third step, the second order moments from the actual Turkish data are computed and compared with the theoretical moments of the benchmark calibration. If the theoretical moments are

close to actual second order moments, then, it can be concluded that the theoretical model offers a good fit for the real (unobservable) model.

5.4.1. Data

Specifically, the standard deviation and the serial correlation for the key variables as well as the correlation of those variables with output will be calculated using Turkish data. The variables constructed are as follows: output, private consumption, government expenditure, hourly wages, public debt, foreign debt, interest rate on public bonds and interest rate on foreign bonds. Data is used to cover a longer time period as possible. Unfortunately, the data on hourly wages in Turkey starts from 2007. Therefore, in order to cover the same period of time, the time span of all data is limited to 2007-2017. All data are chosen as quarterly data; due to availability conditions. From 2007-Q1 to 2017-Q4, the data includes 44 periods.

Quarterly GDP by expenditure data with constant prices from 2007-Q1 to 2017-Q4 is used for output data. The data is taken from OECD website. The data is transformed to logarithm before computing the standard deviation and fourth-order serial autocorrelation. Private consumption and government expenditure data are also taken from the same source. Private consumption data is also logged and its standard deviation, fourth-order serial autocorrelation and correlation with output are calculated. These data are shown below in Figure 5.5, Figure 5.6 and Figure 5.7:

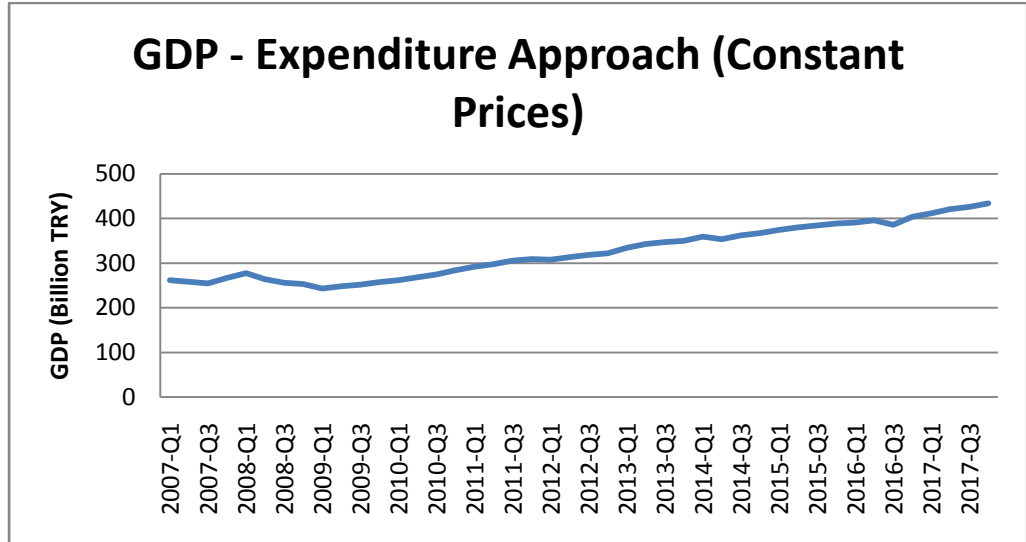


Figure 5.5 GDP of Turkey in constant prices (2007-2017)
Source: OECD (2018a)

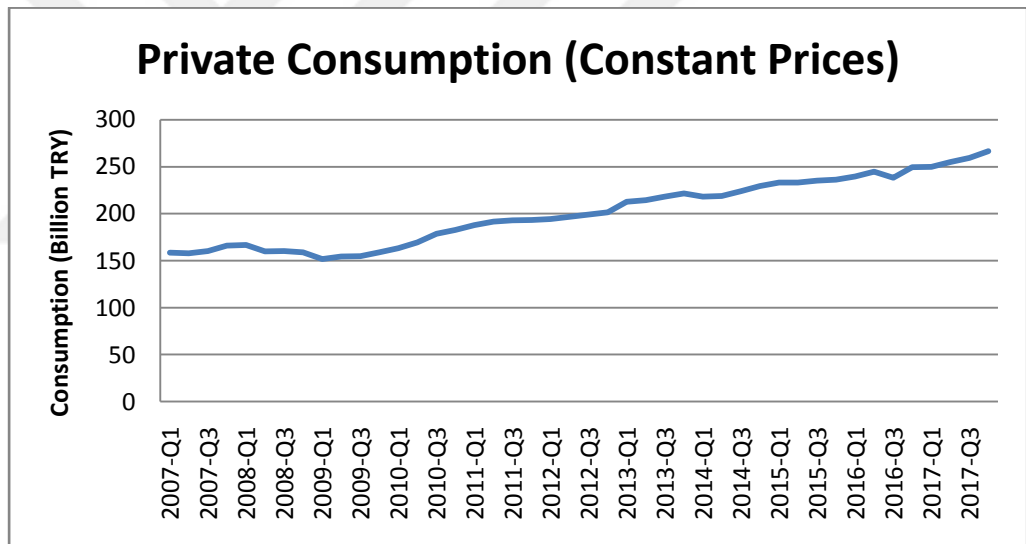


Figure 5.6 Private consumption in Turkey in constant prices (2007-2017)
Source: OECD (2018a)

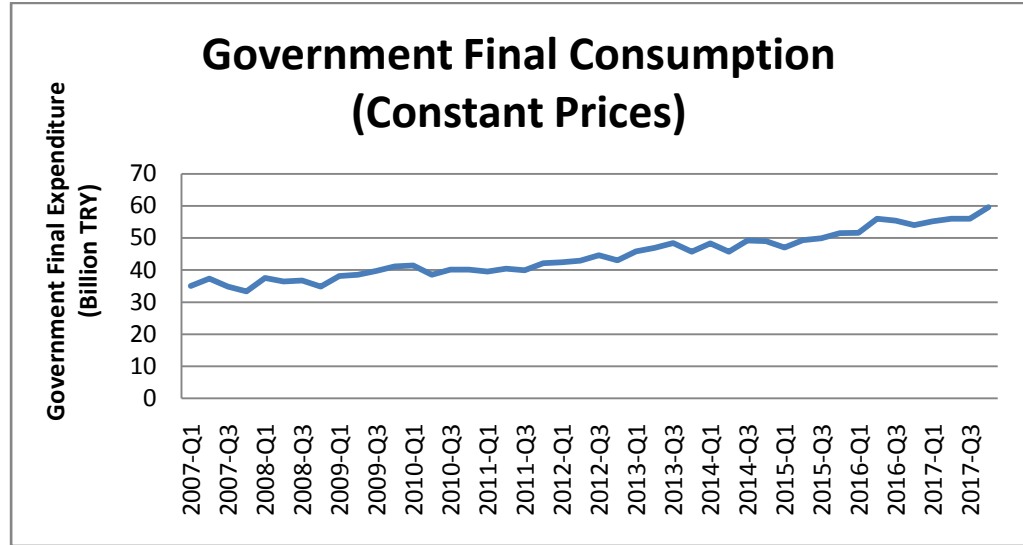


Figure 5.7 Government final consumption in Turkey in constant prices (2007-2017)

Source: OECD (2018a)

Public debt data of Turkey between 2007-Q1 and 2017-Q4 is taken from World Bank data source (World Bank, 2018). The data is also quarterly. The data is labelled as "Gross Public Sector Debt, all maturities, all instruments". The data is given in nominal value, in USD and as ratio of public debt/GDP. The data is illustrated in Figure 5.8 below.

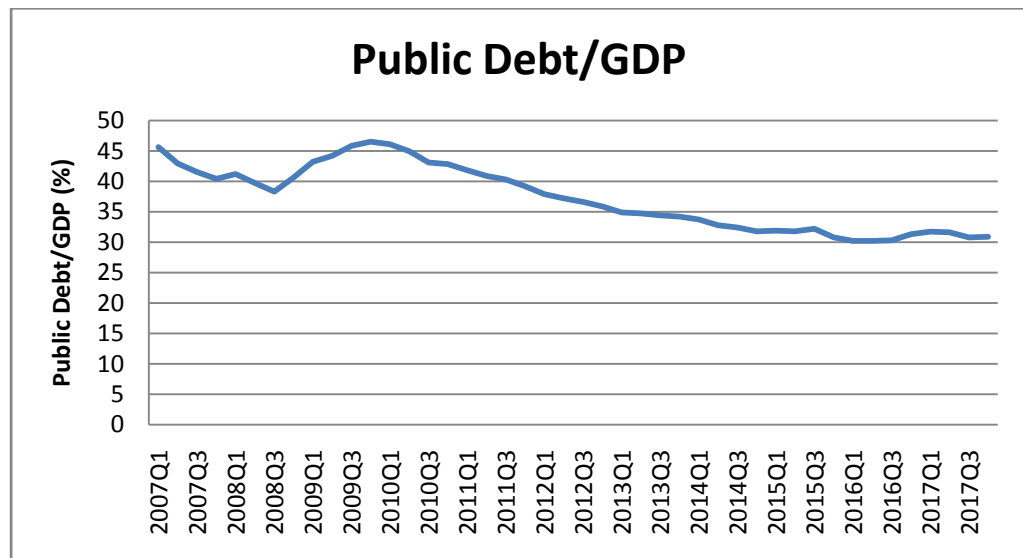


Figure 5.8 Public debt/GDP ratio in Turkey (2007-2017)

Source: World Bank (2018)

In place of foreign debt used in production (Eq. 5.9), CBRT data on "International Investment Position Quarterly" is considered (CBRT, 2018). The net position of Turkey is negative implying a net capital inflow towards Turkey. Therefore, the absolute value of the data is taken. The data is logged and standard deviation, fourth-order autocorrelation and correlation with output are calculated. The data is shown in Figure 5.9 below.

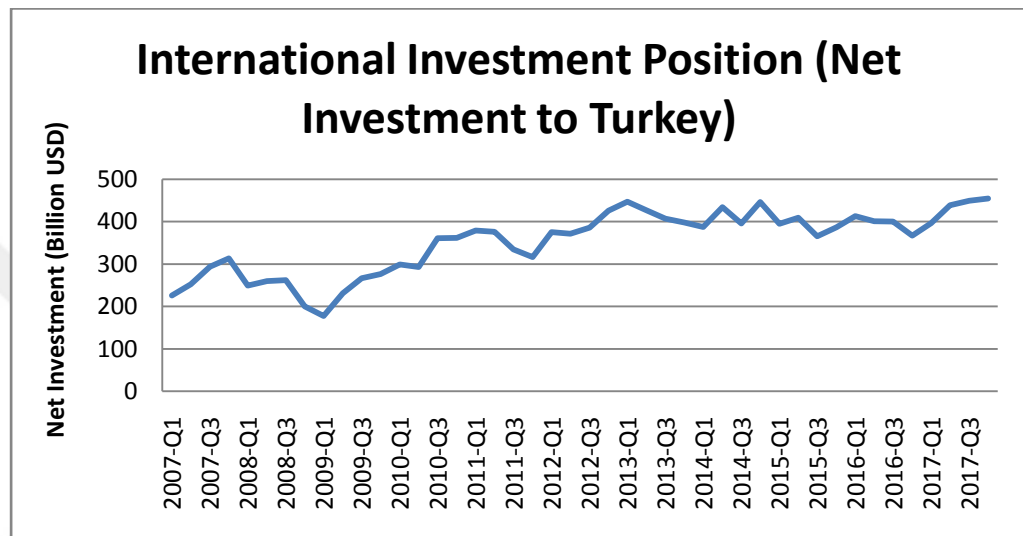


Figure 5.9 Net investment to Turkey (2007-2017)
Source: CBRT (2018)

Data on wages in Turkey is limited. The hourly earnings index published by TURKSTAT (2018a) takes 2010 as the base year. Unfortunately, the data starts in 2007. In order to have the real wage data, the hourly wages are divided by TL/USD exchange rate for each period. The quarterly exchange rate is obtained from (OECD, 2018a). The wage index in USD is given in following Figure 5.10.

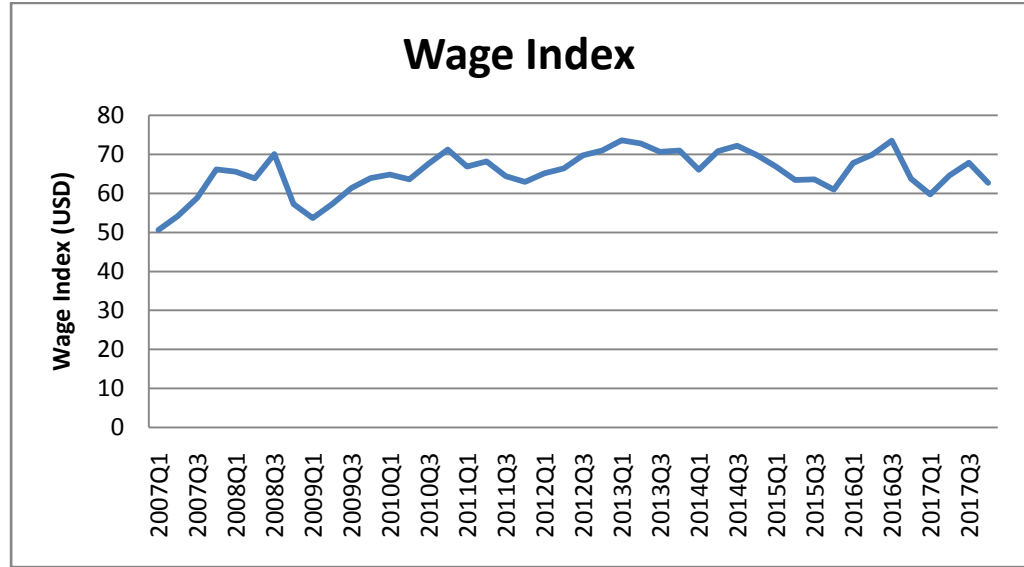


Figure 5.10 Wage index in Turkey (2007-2017) (Base year 2010)
Source: TURKSTAT (2018a) (Own recalculation in US dollar)

5.4.2. Second-Moments

The second-moment analysis of the model is given in following Table 5.2. When the consistency and standard error term of the shock variable is calibrated to meet the real data specifications, the standard deviation of model variables obtained are different than the standard deviation of real data. Serial correlation values of consumption and hourly wages are close to the Turkish data, but serial correlation of foreign debt is not close.

The correlation of hourly wages with output in Turkey is found to be weak. In the benchmark calibration, the correlation is close. This fact can be attributed to the fact that the benchmark calibration does not contain any labour market frictions.

Table 5.2 Second moments: Turkish data and our model

	Turkish Data 2007-Q1 - 2017-Q4			Model		
	Standard deviation	Correlation with output	Serial Correlation	Standard deviation	Correlation with output	Serial Correlation
<i>Output</i>	0.0784	1	0.9612	0.0784	1	0.9612
<i>Consumption</i>	0.0763	0.9950	0.9556	0.0531	0.9979	0.9623
<i>Hourly wages</i>	0.1576	0.4127	0.9686	0.0898	0.9950	0.9719
<i>Foreign debt</i>	0.1030	0.6899	0.8246	0.1119	0.9995	0.9651

5.5. Sensitivity Analysis

In order to measure the sensitivity of the model, three alternative calibrations are designed. In Alternative Calibration - 1, the calibrated ratio of government debt to output ($\overline{D/Y}$) is set to 50%. In this environment, some other variables which depend on this ratio also changed. In addition to this, the values of ρ and σ_e are changed in order to maintain that the standard deviation and serial correlation of output values of the model are equal to the values for Turkish data. In following Table 5.3, the new calibrated values of the variables are given; variables which are not mentioned there did not change.

Table 5.3 Calibrated values for Alternative Calibration - 1

$\overline{D/Y}$	ρ	σ_e	α	t_w
0.5	0.9162	0.0356	0.8905	0.5245

Table 5.4 Second moments for Alternative Calibration - 1

	Turkish Data 2007-Q1 - 2017-Q4			Alternative Calibration - 1		
	Standard deviation	Correlation with output	Serial Correlation	Standard deviation	Correlation with output	Serial Correlation
<i>Output</i>	0.0784	1	0.9612	0.0784	1	0.9612
<i>Consumption</i>	0.0763	0.9950	0.9556	0.0529	0.9985	0.9615
<i>Hourly wages</i>	0.1576	0.4127	0.9686	0.0897	0.9954	0.9710
<i>Foreign debt</i>	0.1030	0.6899	0.8246	0.1118	0.9996	0.9647

In Alternative Calibration - 1, there is not much change in second moments. When ratio of government debt to output is increased, the standard deviations and serial correlations of consumption, hourly wages and foreign debt decreased, and their correlation with output increased marginally.

The Alternative Calibration - 1 reaches to steady state in a shorter period of time, as ρ is smaller. The increase in output and wage is less than the benchmark calibration; also, increase in consumption is less than the benchmark calibration. On the other hand, the increase in foreign debt is also smaller, in line with smaller increase in output. The tax rate on hourly wage earnings increased from 0.5203 to 0.5245; this can be interpreted as a slight increase in taxes to finance the government debt.

When the steady-state debt to output ratio is increased, the tax rate rises. The difference between the targeted debt to output ratio and the actual debt to output ratio decreases. Thus country risk premium declines. This fact explains the lower level of increase in interest rate. Therefore the increase in public debt becomes lower than its level under the benchmark calibration (see Panel c in Figure 5.12). The increase in public spending stimulates demand as in the benchmark model but the stimulation is lower, due to higher tax on wage income. Output increases with a lower ratio. The

increase in labour demand is lower than the benchmark model. Therefore increase in wages is lower (see Panel b in Figure 5.11).

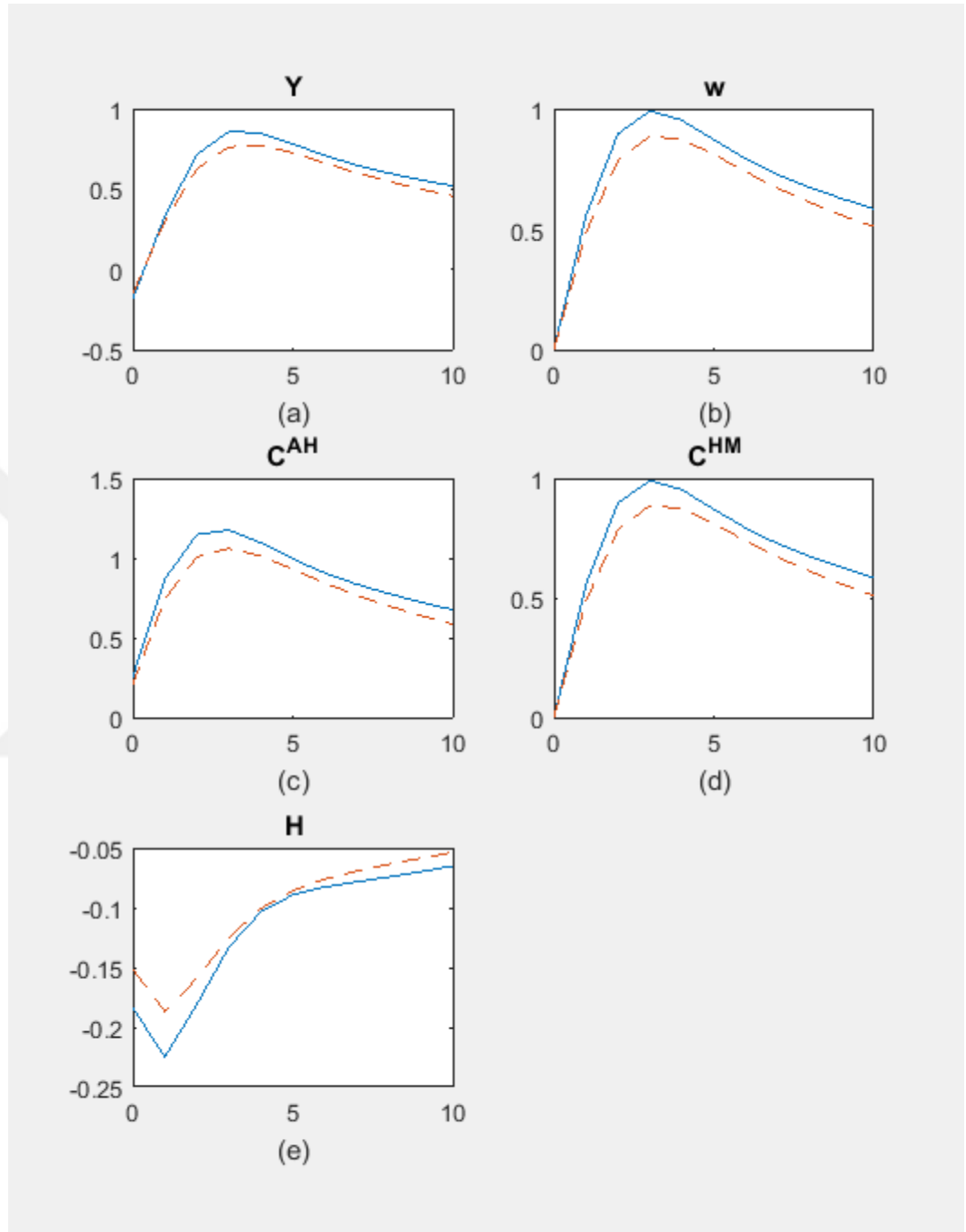


Figure 5.11 The effect of public expenditure shock on households under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

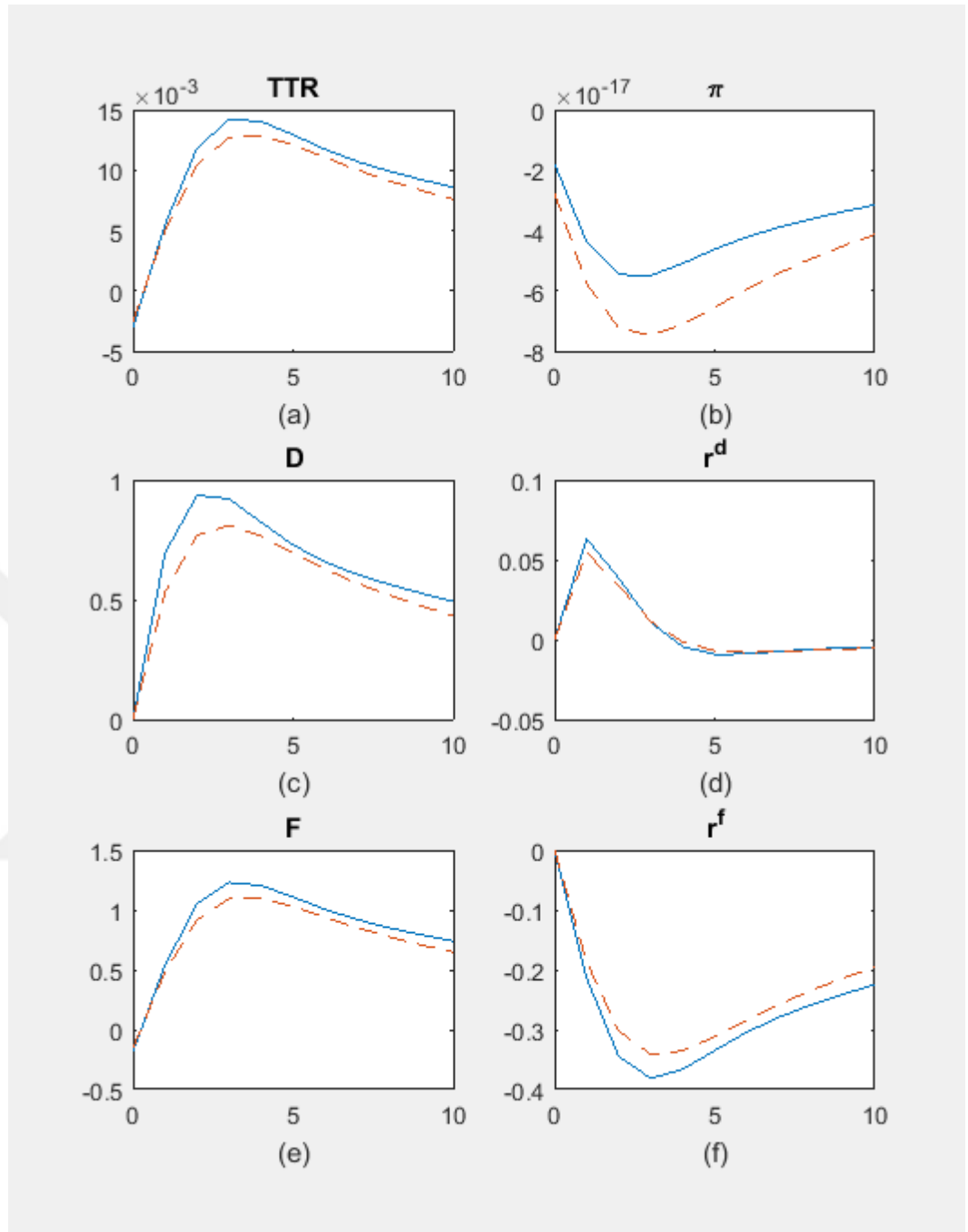


Figure 5.12 The effect of public expenditure shock on public and private sector under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

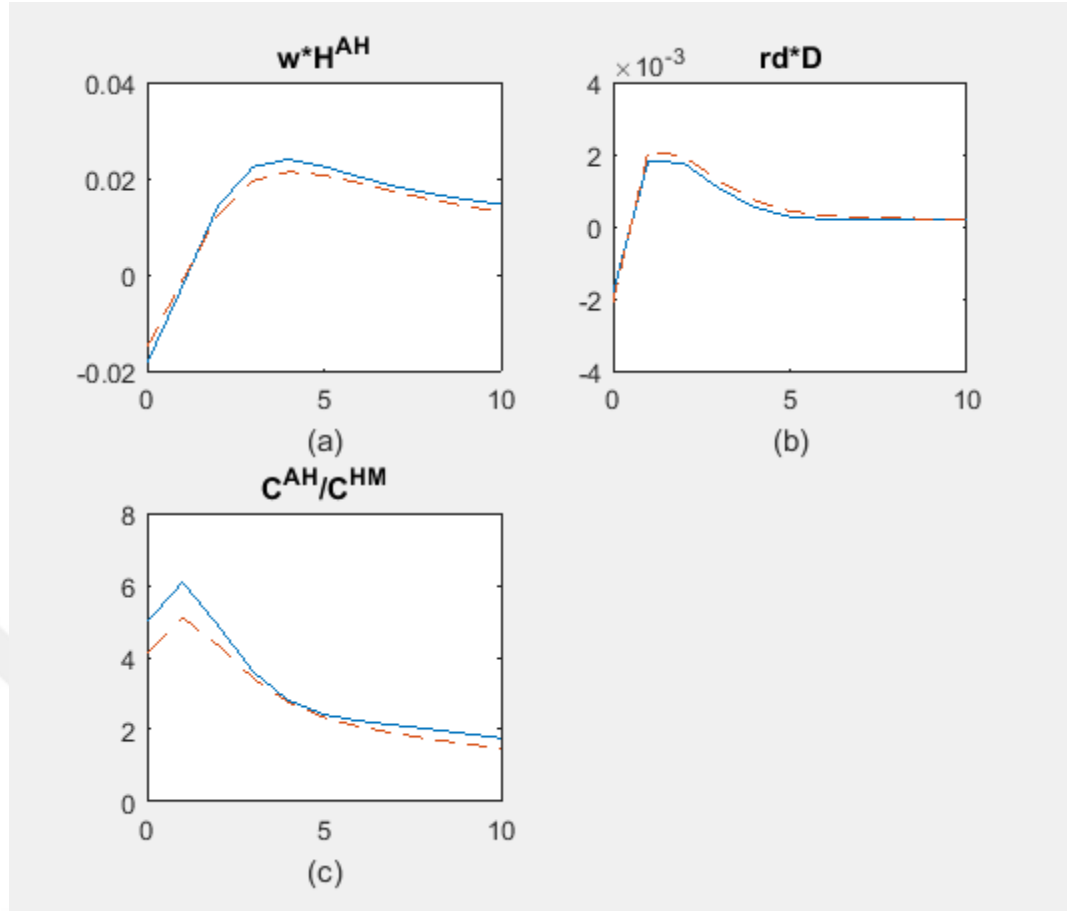


Figure 5.13 The effect of public investment expenditure shock on income distribution under Alternative Calibration - 1

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

The consumption levels by both groups of households are negatively related with tax rate (Eq. (5.4) and (5.7)). In addition to this, wage increase is lower than the benchmark model. These two developments reduce the income effect. On the other hand, interest rate increase is lower, the substitution effect also decreases. The decrease in income effect is more effective, as it is seen that the increase in consumption levels is reduced with respect to the benchmark model (see Panel c and d in Figure 5.11). Total hours of work decrease in a lower rate. The demand increases in a lower rate under alternative calibration, compared to the benchmark calibration. The lower increase in F can be attributed to this fact (see Panel e in Figure 5.12).

A reduction in steady state debt-to-output ratio causes a lower increase in wage income of asset holders. The increase in capital income, on the other hand, is slightly higher than its level under the benchmark calibration. The ratio of consumption by asset holders to consumption by hand-to-mouth households increases, but in a lower rate (see Panel c in Figure 5.13).

In Alternative Calibration - 2, the calibrated ratio of government expenditure to output ratio ($\overline{G/Y}$) is raised to 20%. In this environment, some other variables which depend on this ratio also changed. In addition to this, the values of ρ and σ_e are changed in order to maintain that the standard deviation and serial correlation of output values of the model are equal to the values for Turkish data. In Table 5.5 below, the new calibrated values of the variables are given; variables which are not mentioned there did not change. Second moment values are given in Table 5.6.

Table 5.5 Calibrated values for Alternative Calibration - 2

$\overline{G/Y}$	ρ	σ_e	α	t_w
0.2	0.9549	0.0247	0.9367	0.7466

Table 5.6 Second moments for Alternative Calibration - 2

	Turkish Data 2007-Q1 - 2017-Q4			Alternative Calibration - 2		
	Standard deviation	Correlation with output	Serial Correlation	Standard deviation	Correlation with output	Serial Correlation
<i>Output</i>	0.0784	1	0.9612	0.0784	1	0.9612
<i>Consumption</i>	0.0763	0.9950	0.9556	0.0541	0.9980	0.9691
<i>Hourly wages</i>	0.1576	0.4127	0.9686	0.0906	0.9956	0.9767
<i>Foreign debt</i>	0.1030	0.6899	0.8246	0.1122	0.9996	0.9668

Increasing the ratio of government expenditures increased the standard deviations of the model variables and made them closer to the Turkish data. The

serial correlations and correlation with output increased. Increase in output is similar to the benchmark calibration, increase in wages was smaller, but increase in consumption was similar to the benchmark calibration.

When the steady-state government expenditure to output ratio is increased, the tax rate rises substantially. The increase in level of public debt is also higher, compared to the benchmark model (see Panel c in Figure 5.15). This implies that the increase in government expenditure is financed by increasing taxes and public debt.

The increase in public spending stimulates demand in a higher level as in the benchmark model. Output increases with a higher ratio. The increase in labour demand is higher than the benchmark model. Therefore increase in wages is higher (see Panel b in Figure 5.14).

The consumption levels by both groups of households are negatively related with tax rate (Eq. (5.4) and (5.7)). On the other hand, wage increase is higher than the benchmark model. Income effect on consumption of both groups of households is ambiguous. In addition to this, interest rate increase is lower, the substitution effect decreases. The increase in wages and lower rate of increase in interest rate seem to dominate, since consumption levels increase in a higher ratio with respect to the benchmark model (see Panel c and d in Figure 5.14). Total hours of work decrease in a higher rate. The demand increases in a higher rate under alternative calibration, compared to the benchmark calibration. The higher increase in F can be attributed to this fact (see Panel e in Figure 5.15).

A reduction in steady state debt-to-output ratio causes a higher increase in wage income of asset holders. The increase in capital income, on the other hand, is very slightly higher than the benchmark model. The ratio of consumption by asset holders to consumption by hand-to-mouth households increases in higher rate (see Panel c in Figure 5.16). It is seen that if the government expenditure to output ratio is raised, the income inequality worsens.

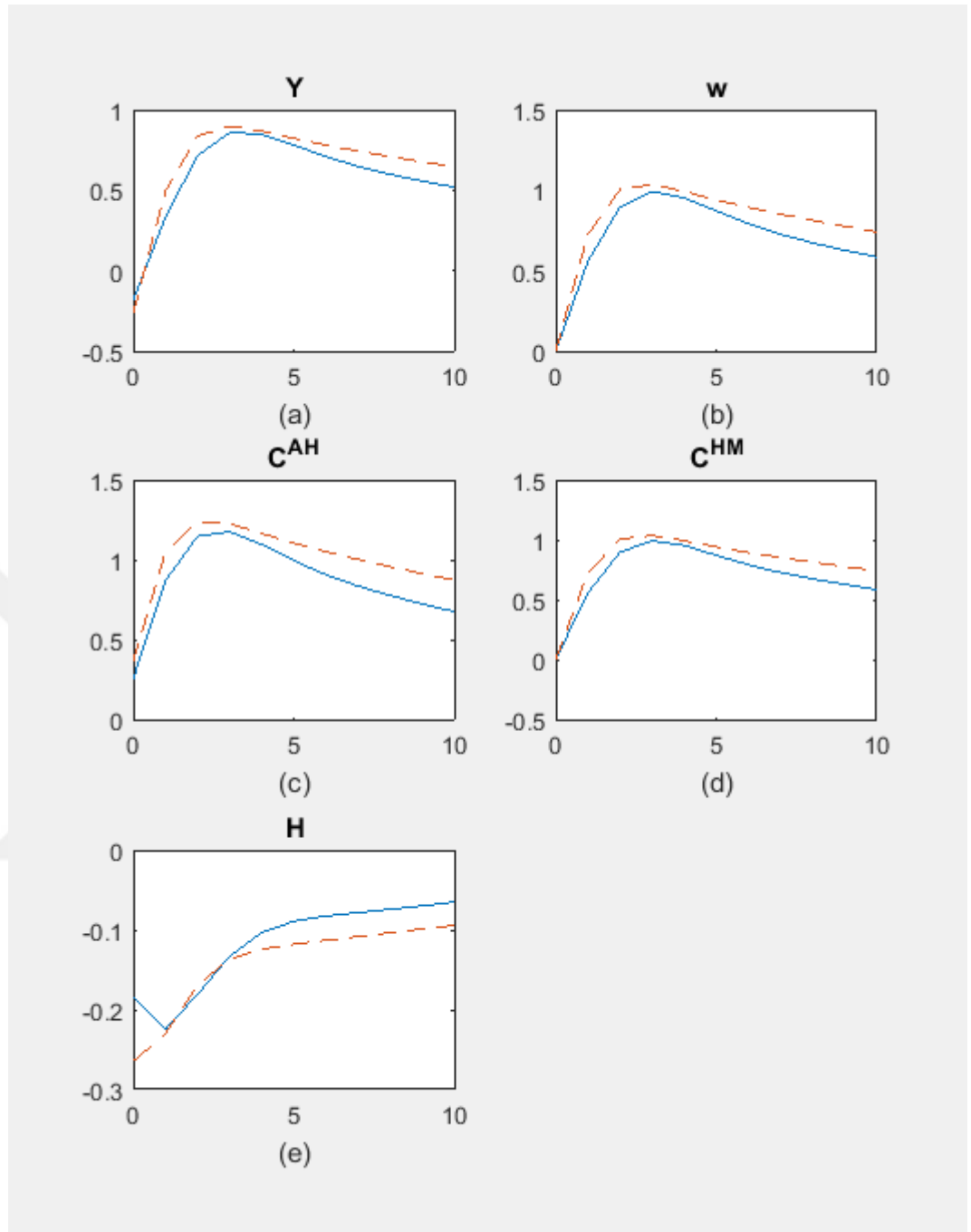


Figure 5.14 The effect of public expenditure shock on households under Alternative Calibration - 2

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

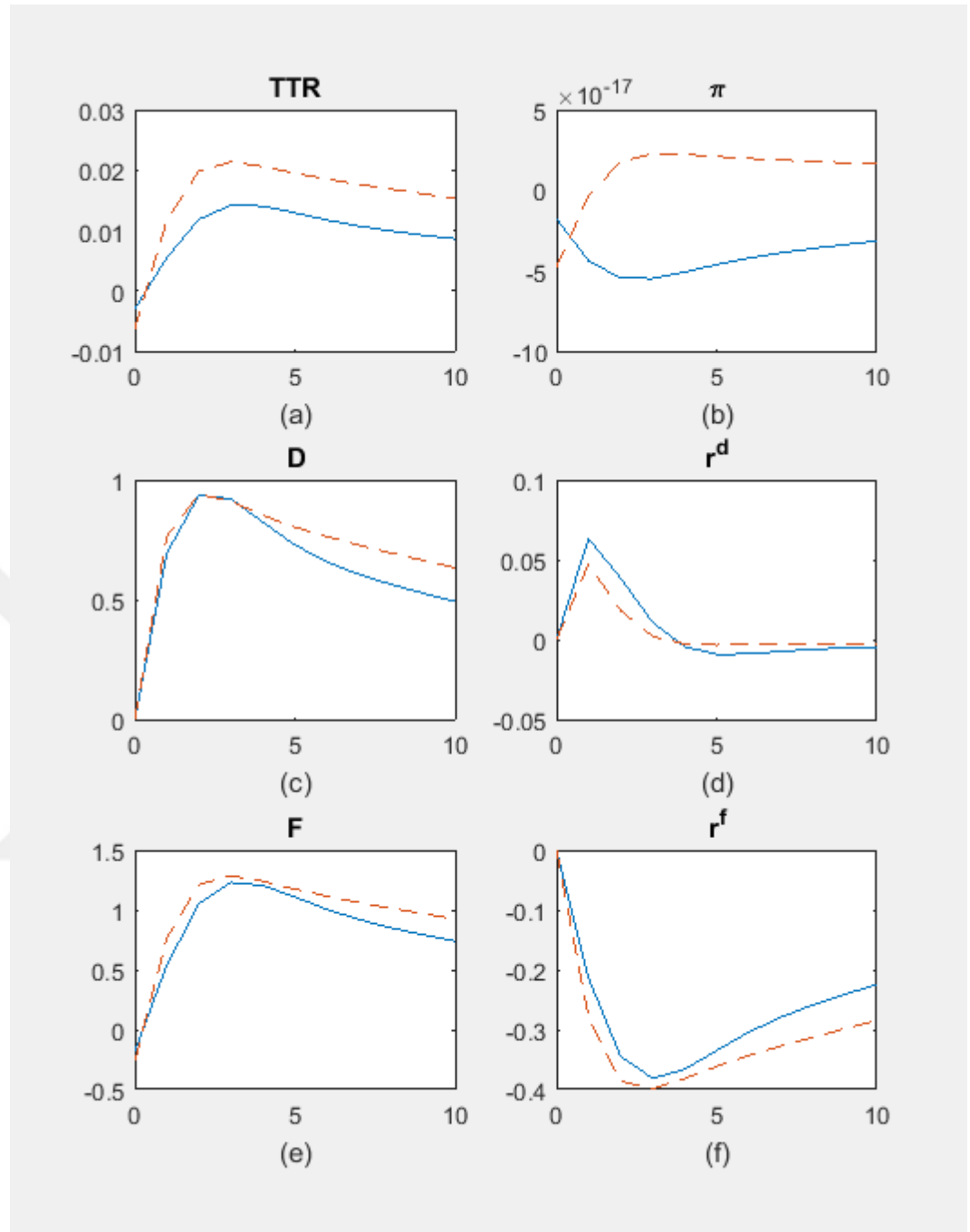


Figure 5.15 The effect of public expenditure shock on public and private sector under Alternative Calibration - 2

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

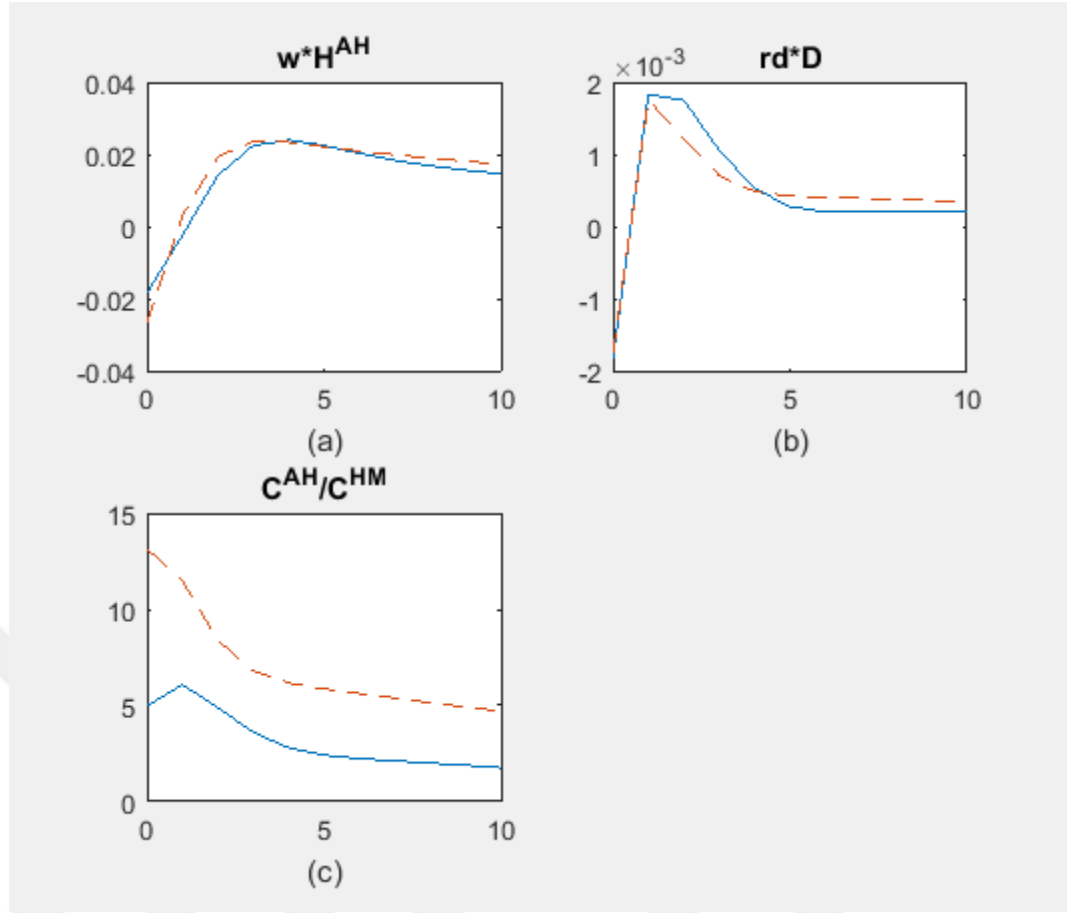


Figure 5.16 The effect of public investment expenditure shock on income distribution under Alternative Calibration - 2

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

In Alternative Calibration - 3, the calibrated ratio of hand-to-mouth households in total population (η) is 50%. In this environment, some other variables which depend on this ratio also changed. The values of ρ and σ_e are adjusted in order to maintain that the standard deviation and serial correlation of output values of the model are equal to the values for Turkish data. Also, the hours of work by hand-to-mouth households and asset holder households are recalculated, in order to maintain that the weighted average of hours should be equal to 7.05/24. If it is assumed that the half of population consists of asset holder households and the other half are hand-to-mouth households, the following equation must be maintained:

$$\frac{7.05}{24} = 0.5H^{AH} + 0.5H^{HM}$$

As H^{AH} is calibrated as 0.3333, H^{HM} must be 0.2542.

In following Table 5.7, the new calibrated values of the variables are given; variables which are not mentioned there did not change. Second moment values are given in Table 5.8.

Table 5.7 Calibrated values for Alternative Calibration - 3

η	H^{HM}	ρ	σ_e	α	t_w
0.5	0.2542	0.8865	0.0423	0.8433	0.5273

Table 5.8 Second moments for Alternative Calibration - 3

	Turkish Data 2007-Q1 - 2017-Q4			Alternative Calibration - 3		
	Standard deviation	Correlation with output	Serial Correlation	Standard deviation	Correlation with output	Serial Correlation
<i>Output</i>	0.0784	1	0.9612	0.0784	1	0.9612
<i>Consumption</i>	0.0763	0.9950	0.9556	0.0539	0.9975	0.9512
<i>Hourly wages</i>	0.1576	0.4127	0.9686	0.0933	0.9927	0.9646
<i>Foreign debt</i>	0.1030	0.6899	0.8246	0.1132	0.9993	0.9628

When the ratio of asset holders and hand-to-mouth households and the hours of work by hand-to-mouth households are changed in Alternative Calibration - 3, the standard deviations of variables increased and serial correlations decreased. Correlations with output decreased, although more slightly.

The hours of work by hand-to-mouth households reduces if the ratio of hand-to-mouth households to total population is reduced. Labour supply by hand-to-mouth households decreases. On the other hand, the rate of tax on wage income increases.

These explain the lower rate of increase in C^{HM} compared to the benchmark calibration (see Panel d in Figure 5.17). The demand increases in a lower rate, so the labour demand also decreases in a higher rate. The wage level increases in a lower rate than the benchmark model.

The lower level of increase in demand results in lower level of increase in public debt. The interest rate decreases after a period of increase. The lower level of increase in wage and higher tax rates lead to lower consumption by asset holders (see Panel c in Figure 5.17). As the demand is lower, F increases with a lower rate (see Panel e in Figure 5.18).

A reduction in the ratio of hand-to-mouth households to total population causes a lower increase in wage income of asset holders. Capital income decreases when the rate of interest rate decreases. The ratio of consumption by asset holders to consumption by hand-to-mouth households increases in lower (see Panel c in Figure 5.19). It is seen that if the ratio of hand-to-mouth households to total population decreases, the negative effect of government policy on the income distribution decreases.

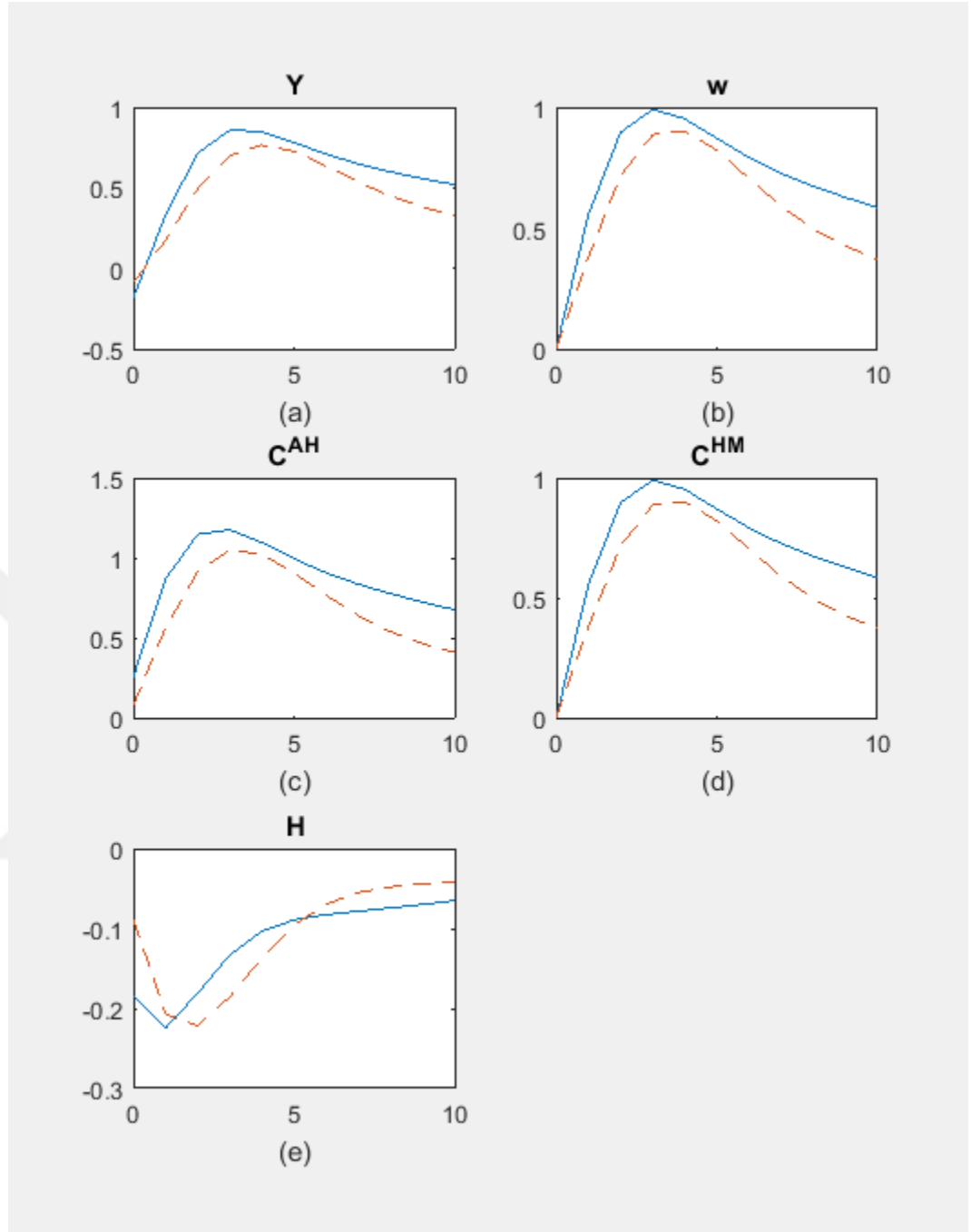


Figure 5.17 The effect of public expenditure shock on households under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

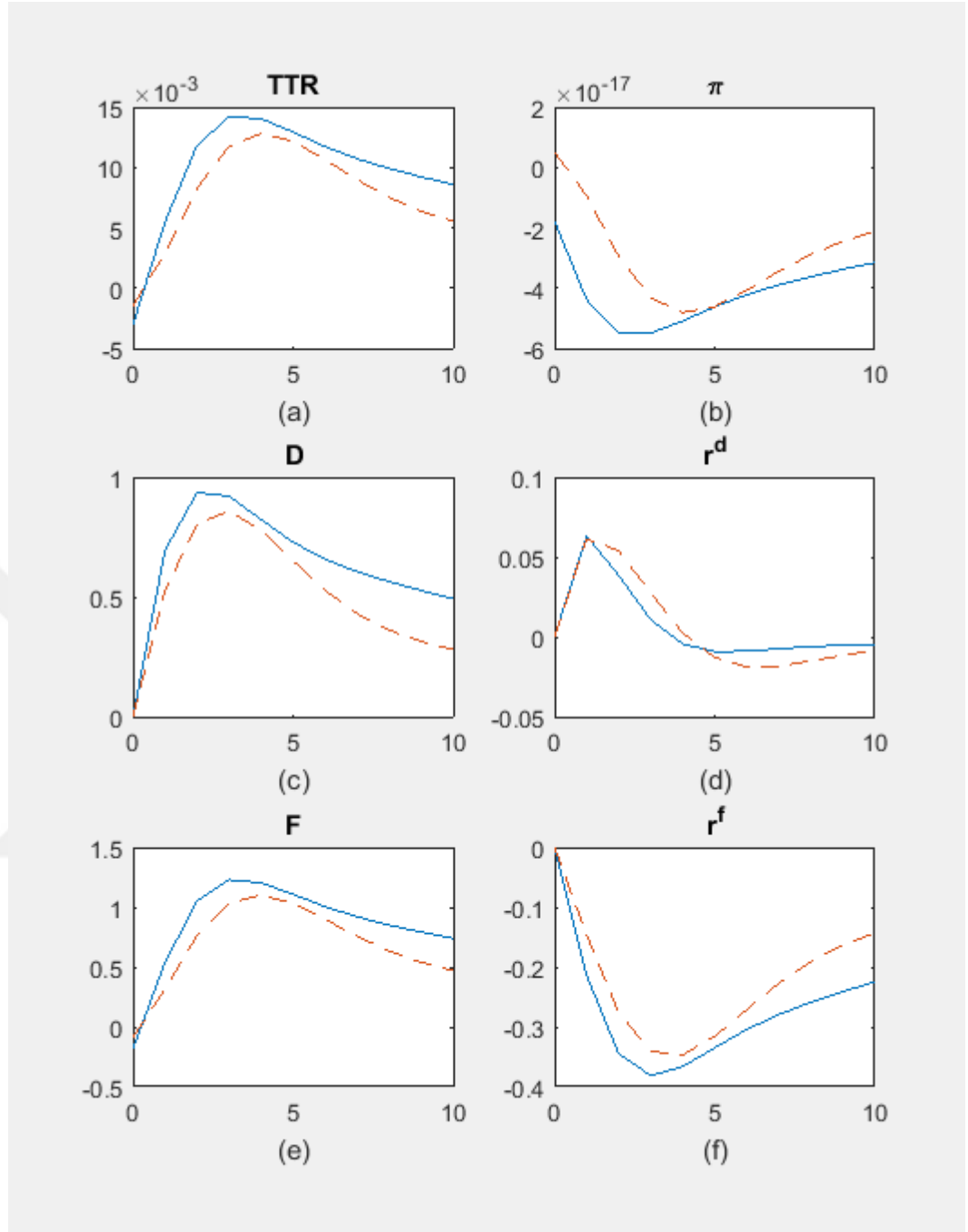


Figure 5.18 The effect of public expenditure shock on public and private sector under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

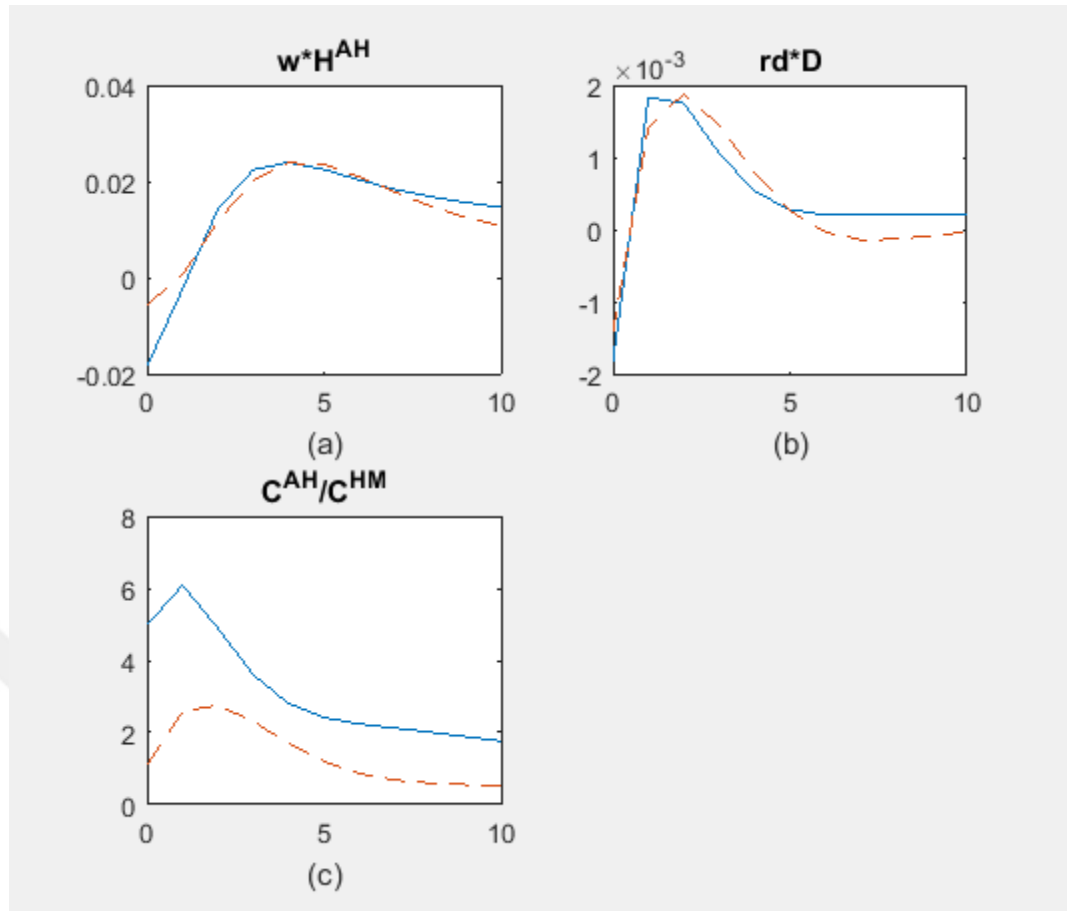


Figure 5.19 The effect of public investment expenditure shock on income distribution under Alternative Calibration - 3

Notes: *x-axis denotes time in quarters while y-axis denotes the percentage deviation from the steady-state. The benchmark calibration is shown with a solid line, whereas alternative calibration is represented with dashed line.*

5.6. Conclusion

The present chapter develops a theoretical small open economy model with one type of firms and two types of households. The households, similar to the previous chapter, have different sources of income. The first group, asset holders, has capital income and labour income whereas the second group, hand-to-mouth households, has only labour income and does not save. The government expenditure as assumed to be financed by domestic debt in addition to taxes on wage income. The firms are assumed to use non-stock physical capital, financed by foreign investment. As there is one group of firms, wage levels of the households are not differentiated, which was done in the previous chapter. The homogenous wage rate

allows for focusing on the effect of government spending shock on financial income, rather than the wage income.

Government spending is not used for infrastructural investment, differently from the previous chapter. In such an environment, a temporary shock in government expenditures results in increasing income inequality. The wage income of asset holders rises, however this is related to the assumption that asset holders work for more hour than the hand-to-mouth households. The capital income, which is earned by asset holders, rises with increasing public debt.

Public bonds are assumed to be sold to domestic residents, whereas the capital of firms is assumed to be foreign capital. This limitation is asserted in order to focus on the domestic debt. The real interest rate on public bonds and rental rate of foreign capital are assumed to be equal to each other in steady-state. The interest rate on public bonds includes a debt-elastic risk premium.

The comparison of second moments of the model with Turkish data reveals that consumption is highly correlated with output in Turkey, similar to the model. Correlation of hourly wages with output, on the other hand, is very low, different from the model. Wages also have higher standard deviation. Foreign debt has a higher correlation with output in Turkey, but it is still lower, compared to the model.

The sensitivity analysis resulted in quantitative changes in most of the variables. This demonstrates that assumptions are well-defined. According to the sensitivity analysis, an increase in the steady-state public debt-to-output ratio, all other thing being constant, decreases the deterioration in the income inequality by decreasing the risk premium on interest rate. An increase in steady-state public expenditures-to-output ratio deteriorates income distribution more due to a substantial increase in the rate of tax on wage income. A decrease in the ratio of hand-to-mouth households in the total population decreases the relative increase in the public debt and the interest risk premium, thus decreases the income inequality deterioration.

The present chapter contributes the existing literature by assuming a small open economy exporting foreign non-stock capital. The risk premium on interest rate dependent on the debt position of the public sector is used in the domestic public bond market. The foreign capital market and public bond market are separated. The model is designed to focus on the effect of public debt on the income distribution within the country.

The setup presented in this chapter can be developed in different ways. As mentioned before, the real business cycle model can be amended to include the nominal prices. The labour market imperfections can be included, as the second moment analysis indicates. Taxes levied by government can be diversified. Wages of different groups of households can also be diversified.

6. CONCLUSION

The present study used dynamic general equilibrium models of a small open economy within a real business cycle framework. The links between the theoretical models and the real world are constructed via an analysis of macro- and micro-data on Turkish economy. The macro-data included public debt and budget financing data, among others, whereas micro-data included different types of incomes and total incomes earned by a substantial number of households. Both groups of data covered the majority of years since 2000s.

The analysis on income distribution in Turkey is limited to the area that is expected to be related with the public debt. Public debt is assumed to affect the income distribution via taxes, social transfers and financial income. As the micro-data does not include information on tax payments by individuals, the effect of public debt on income distribution is analysed via the financial income and social transfers. Factor decomposition method is used for this aim.

The theoretical models used in this study are designed to analyse the effect of cyclical fiscal policies on income distribution and they included a temporary government spending shock, rather than technological shock, which is preferred in the vast majority of general equilibrium models. This is a contribution to the existing literature.

Agent heterogeneity, which is used in theories of income distribution since long time, is used in the present theoretical models. The household heterogeneity and firm heterogeneity is adopted together in the first model. The effect of public spending to income distribution is studied through infrastructural government

investment in one type of these firms. This is another contribution to the existing literature.

The models used in the study show that the debt-financed public investment, aiming at the low-quality firms which employ less-educated workforce, has an improving effect on income inequality. A debt-financed public consumption spending, on the other hand, has negative effects of income distribution.

Sensitivity analysis in both models shows that the implications of a government spending shock do not change qualitatively when the calibrated values are changed. The differences in calibration have quantitative effects on the path of variables, but the directions of the variables do not change. This proves the robustness of the model.

The micro-data of Turkey used in the study does not contain tax payments by individuals or households. If there were detailed, nor aggregate, data on tax payments by households or individuals, the effect of taxes on income distribution in Turkey would be analysed. The first theoretical model designed in this study includes two types of taxes (on wage and asset income) and second model includes only one (tax on wage income). Future study should aim a more comprehensive analysis on the effect of public debt on income distribution via taxes; and the tax variables in the theoretical models should be defined in more detail.

The theoretical models assume perfectly competitive markets. This assumption should be abolished in future research, in order to fit the model to the Turkish economy in a better way.

The majority of population has negative saving rates. The theoretical models do not include the banking sector and credit. Further research should focus on the effect of public debt on income distribution under the assumption of indebtedness of a portion of the population.

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APPENDIX

Appendix A: Equations Used in Chapter 4

$$H_t^{AH} = 1 - \frac{C_t^{AH} (1 - \alpha)}{\alpha w_t^{AH} (1 - t_w)}$$

$$C_t^{AH \alpha - 1} (1 - H_t^{AH})^{1 - \alpha} = E_t \left[\beta C_t^{AH \alpha - 1} (1 - H_{t+1}^{AH})^{1 - \alpha} (1 + r_{t+1}^d - t_a) \right]$$

$$K_{t+1} = (1 - \phi) K_t - I_t$$

$$C_t^{HM} = (1 - t_w) w_t^{HM} H_t^{HM}$$

$$H_t^{HM} = \theta$$

$$Y_t^{HQ} = A_t H_t^{AH \delta} K_t^{1 - \delta}$$

$$K_t = \frac{Y_t^{HQ}}{r_t^d} (1 - \delta)$$

$$H_t^{AH} = \frac{Y_t^{HQ}}{w_t^{AH}} \delta$$

$$Y_t^{LQ} = A_t (H_t^{HM})^\gamma (G_t^i)^{1 - \gamma}$$

$$H_t^{HM} = \frac{Y_t^{LQ}}{w_t^{HM}} \gamma$$

$$\ln G_{t+1}^i = \rho \ln G_t^i + \varepsilon_{t+1}$$

$$t_w \left[(1 - \eta) w_t^{AH} H_t^{AH} + \eta w_t^{HM} H_t^{HM} \right] + t_a K_t = Y_t^{HQ} + Y_t^{LQ} - (1 - \eta) C_t^{AH} - \eta C_t^{HM} - I_t$$

Appendix B: Steady-State Values of Variables Used in Chapter 4

$$r^d = \frac{1}{\beta} - 1 + t_a$$

$$K = H^{AH} \left[\frac{1-\delta}{r^d} \right]^{1/\delta}$$

$$I = \phi K$$

$$Y^{HQ} = A_t H^{AH \delta} K^{1-\delta}$$

$$w^{AH} = \frac{Y^{HQ}}{H^{AH}} \delta$$

$$H^{HM} = \theta$$

$$H^{AH} = 1/3$$

$$Y^{LQ} = \left(\frac{Y^{LQ}}{Y^{HQ}} \right) Y^{HQ}$$

$$G^i = \left(\frac{Y^{LQ}}{H^{HM \gamma}} \right)^{1/(1-\gamma)}$$

$$w^{HM} = \frac{Y^{LQ}}{H^{HM}} \gamma$$

$$C^{AH} = w^{AH} (1-t_w)(1-H^{AH}) \frac{\alpha}{1-\alpha}$$

$$C^{HM} = (1-t_w) w^{HM} H^{HM}$$

Appendix C: Log-Linearized Forms of Equations Used in Chapter 4

$$\tilde{C}_t^{AH} = \tilde{w}_t^{AH} + \left(\frac{H^{AH}}{H^{AH} - 1} \right) \tilde{H}_t^{AH}$$

$$(\alpha - 1)\tilde{C}_{t+1}^{AH} + \left(\frac{(\alpha - 1)H^{AH}}{1 - H^{AH}} \right) \tilde{H}_{t+1}^{AH} + \left(\frac{r^d}{1 + r^d - t_a} \right) \tilde{r}_{t+1}^d =$$

$$(\alpha - 1)\tilde{C}_t^{AH} + \left(\frac{(\alpha - 1)H^{AH}}{1 - H^{AH}} \right) \tilde{H}_t^{AH} + (\alpha - 1)(\tilde{C}_{t+1}^{AH} - E_t \tilde{C}_{t+1}^{AH}) + \left(\frac{(\alpha - 1)H^{AH}}{1 - H^{AH}} \right) (\tilde{H}_{t+1}^{AH} - E_t \tilde{H}_{t+1}^{AH}) +$$

$$\left(\frac{r^d}{1 + r^d - t_a} \right) (\tilde{r}_{t+1}^d - E_t \tilde{r}_{t+1}^d)$$

$$\tilde{H}_t^{HM} = 0$$

$$\tilde{C}_t^{HM} = \tilde{w}_t^{HM} + \tilde{H}_t^{HM}$$

$$\tilde{Y}_t^{HQ} = \delta \tilde{H}_t^{AH} + (1 - \delta) \tilde{K}_t$$

$$\tilde{r}_t^d = \tilde{Y}_t^{HQ} - \tilde{K}_t$$

$$\tilde{w}_t^{AH} = \tilde{Y}_t^{HQ} - \tilde{H}_t^{AH}$$

$$\tilde{I}_t = (1/\phi) \tilde{K}_{t+1} - (1 - \phi) \tilde{K}_t$$

$$\tilde{Y}_t^{LQ} = \gamma \tilde{H}_t^{HM} + (1 - \gamma) \tilde{G}_t^i$$

$$\tilde{w}_t^{HM} = \tilde{Y}_t^{LQ} - \tilde{H}_t^{HM}$$

$$\tilde{G}_{t+1}^i = \rho \tilde{G}_t^i + \tilde{\varepsilon}_{t+1}$$

$$t_w(1 - \eta)w^{AH}H^{AH}\tilde{w}_t^{AH} + t_w(1 - \eta)w^{AH}H^{AH}\tilde{H}_t^{AH} + t_w\eta w^{HM}H^{HM}\tilde{w}_t^{HM} + t_a K \tilde{K}_t =$$

$$Y^{LQ}\tilde{Y}_t^{LQ} + Y^{HQ}\tilde{Y}_t^{HQ} - (1 - \eta)C^{AH}\tilde{C}_t^{AH} - \eta C^{HM}\tilde{C}_t^{HM} - \tilde{I}_t I$$

Appendix D: Equations of the Model Used in Chapter 5

$$\lambda_t = -\alpha C_t^{AH\alpha-1} (1-H_t^{AH})^{1-\alpha}$$

$$\lambda_t = \frac{-(1-\alpha)C_t^{AH\alpha} (1-H_t^{AH})^{-\alpha}}{(1-t_w)w_t}$$

$$\lambda_t = \lambda_{t+1} r_{t+1}^d \beta$$

$$C_t^{HM} = (1-t_w)w_t H_t^{HM}$$

$$H_t^{HM} = \theta$$

$$Y_t = A_t H_t^\delta F_t^{1-\delta}$$

$$F_t = \frac{Y_t}{(1+r_t^f)} (1-\delta)$$

$$H_t = \frac{Y_t}{w_t} \delta$$

$$D_{t+1} = G_t + (1+r_t^d)D_t - t^w w_{t+1} H_{t+1}$$

$$r_{t+1}^d = R^* + \psi \left[e^{\frac{D_{t+1} - \bar{D}}{Y^{t+1} - \bar{Y}}} - 1 \right]$$

$$\ln G_{t+1} = \rho \ln G_t + \varepsilon_{t+1}$$

$$F_{t+1} - F_t = r_t^f F_t + C_t + G_t - Y_t$$

Appendix E: Steady State Values of Variables Used in Chapter 5

$$H^{HM} = \theta$$

$$H^{AH} = 1/3$$

$$r^d = R^*$$

$$r^f = R^*$$

$$Y = H \left[(1-\delta)^{(1-\delta)/\delta} \left[(1+r^f)^{(\delta-1)/\delta} \right] \right]$$

$$w = \delta Y / H$$

$$F = (1-\delta)Y / (1+r^f)$$

$$C^{HM} = (1-t^w)wH^{HM}$$

$$C^{AH} = \alpha(1-H^{AH})(1-t^w)w/(1-\alpha)$$

$$\lambda = -\alpha C^{AH^{\alpha-1}} (1-H^{AH})^{1-\alpha}$$

$$G = Y - r^f F - C - G$$

$$D = \frac{wHt_w - G}{r^d}$$

ABOUT THE AUTHOR

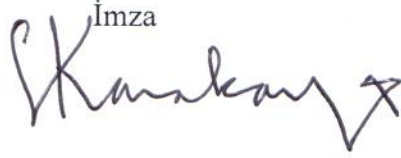
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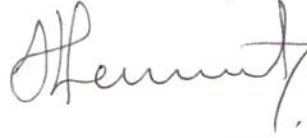
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