PUBLIC CONSUMPTION AND GOVERNMENT EXPENDITURE IN 6 OECD COUNTRIES and THEIR EFFECT IN MACROECONOMETRIC MODELS OF DISEQUILIBRIUM, 1970-2016

GUISAN, Maria-Carmen

Abstract

There are some controversies about the Wagner´s Law and the effects of Government expenditure on economic development, and we analyze those controversies from the approach of Macroeconometric models of disequilibrium that have into account not only demand and supply of primary inputs but also the important approach of supply of intermediate inputs. We present data analyzing the evolution of private and public consumption, investment, general government expenditure and private and public debt in 6 OECD countries (France, Germany, Italy, Spain, UK and USA) for the period 1970-2016. We find that public consumption and general government expenditure per capita increase with economic development and their evolution is compatible with increases of consumption and investment of the private sector if the relationships of demand and supply are considered. For developed countries we advise to avoid excessive austerity policies, as those imposed by the European Union for the period 2008-2018 in several countries, because they damage both public and private development. For developing countries we advise to focus on the main factor of economic development (human capital, industry and investment) because they are usually the keys to allow them to increase low levels of government expenditure per capita and their low levels of consumption per capita.

Keywords: Public Consumption, General Government Expenditure, OECD countries, Macroeconometric model of disequilibrium, Demand, Supply of Primary Inputs, Supply of Intermediate Inputs.

JEL codes:

1. Introduction

Guisan(2013), presents a general view of macroeconometric model of disequilibrium with three regimes: demand, supply of primary inputs and supply of intermediate inputs. The presentation of the model was simplified regarding the role of public sector. Given that there are a concern in the economic literature about the prevalence of the Keynes approach versus Wagner´s approach to the role of public expenditure on consumption, we here present a more detailed version regarding the role of the public sector.

From the point of view of disequilibrium the Keynes´ approach works properly when the restriction to growth and development is explained by the demand side and then the increase of the aggregate demand increases production and other variables. The so-called Wagner´s approach, that explains public consumption as caused by economic growth and development. This approach explains adequately the relationship between government expenditure and economic growth when the restrictions to development comes from the supply side.

Section 2 shows the evolution of the ratios of Consumption and Investment on Gross Domestic Product (GDP) in 6 OECD countries for the period 1970-2010. Besides we include a table with the evolution of the ratios of Public Consumption, Current Government Expenditure, Public Investment and Total Government Expenditure in 4

OECD countries for the period 1970-2011. The graphs and the table show a generally moderate increase of the ratio of Public Consumption to GDP, although with an important exception in the case of data of the United States (with an important decrease) and Spain (with an important increase towards convergence with other European countries).

Section 3 analyses the main factors of economic development and the role of Government.

Section 4 presents an expansion of the model of disequilibrium suggested by Guisan(2013) where the main equation of Consumption refers to Total Consumption (Private and Public) instead of only Private Consumption.

Section 5 presents de main conclusions.

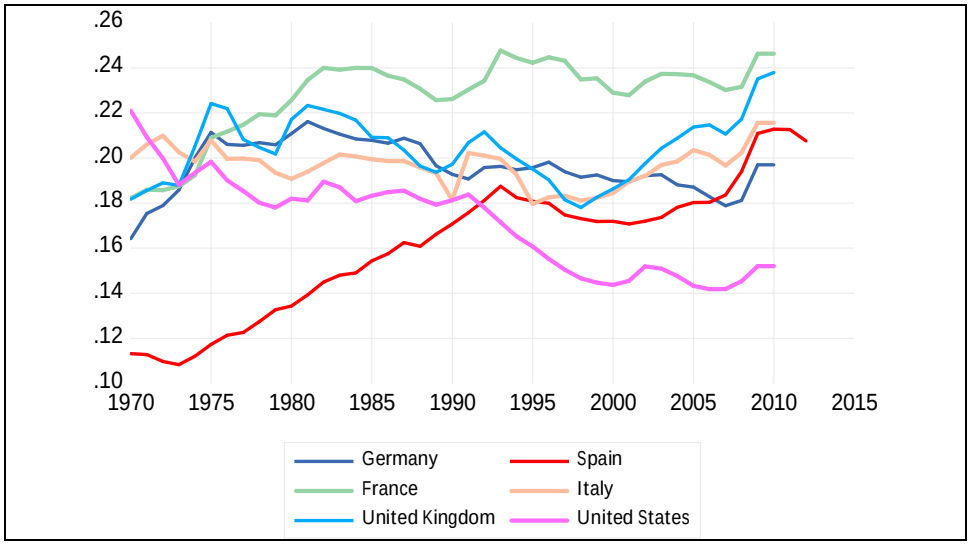
2. Evolution of Consumption, Investment and Public Expenditure in 6 OECD countries, 1970-2011

Consumption and Investment

Graphs 1 to 3 present, respectively the evolution of the ratios of Public Consumption, Total Consumption and Investment to Gross Domestic Product (GDP) in the 6 OECD countries of this study for the period 1970-2010.

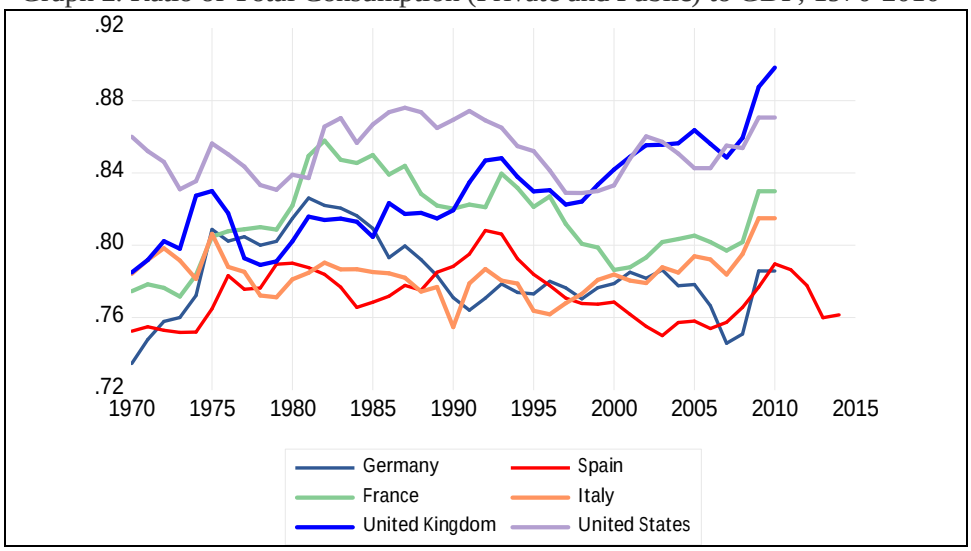
The ratio of Public Consumption on GDP usually has been between 0.16 and 0.26 in the 6 countries of this study for the period 1970-2010. The highest ratio in year 2010 corresponded to France and the United Kingdom, followed by Italy, Spain and Germany, and the lowest values to the United States. The greatest difference has happened in Spain (from a minimum around 0.12 to a maximum near 0.22, and in the USA with a maximum of 0.22 and a minimum around 0.15.

Graph 1. Ratio of Public Expenditure on Consumption to GDP, 1970-2010



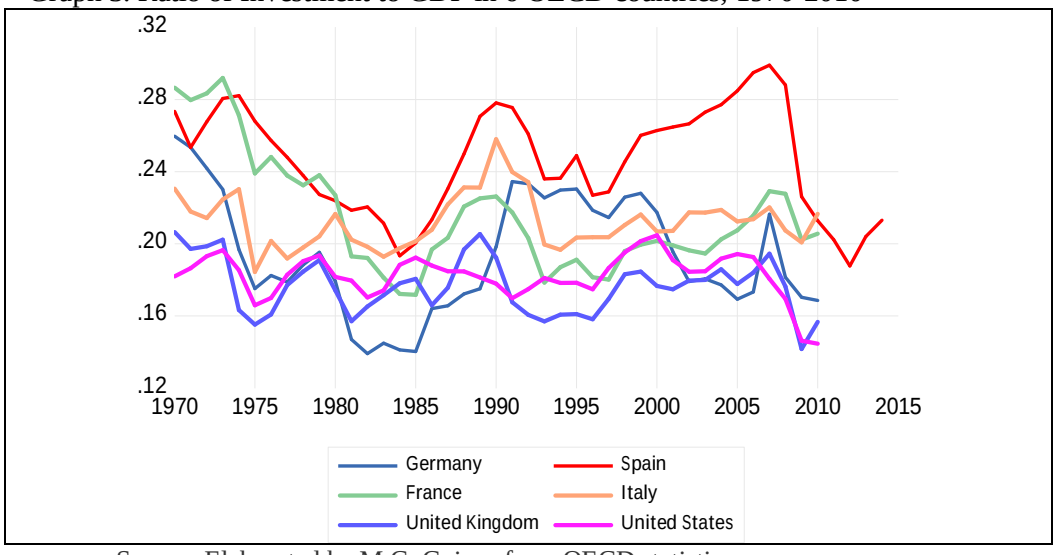
Source: Elaborated by M.C. Guisan from OECD statistics

Graph 2. Ratio of Total Consumption (Private and Public) to GDP, 1970-2010



Source: Elaborated by M.C. Guisan from OECD statistics

Graph 3. Ratio of Investment to GDP in 6 OECD countries, 1970-2010



Source: Elaborated by M.C. Guisan from OECD statistics

France, Germany, Italy and the UK show a high degree of stability, with some oscillations, while Spain started from a low ratio in year 1970 and has experienced a strong increase afterwards and the USA started with a high ratio in 1970 and has shown a decreasing evolution, particularly after year 1992.

The ratio of Total Consumption has usually evolved between 0.76 and 0.88. In year 2010 the highest ratios corresponded to UK and USA, while France and Italy show an intermediate situation and Germany and Spain present the lowest values of the ratio. In the case of Germany the low value of the ratio of Total Consumption is due to the high

value of the positive balance of foreign trade (BT), and in the case of Spain it is due to the high value of the ratio of Investment.

The ratio of Investment has usually evolved between 0.16 and 0.28. Sometimes an increase of this ratio has implied increase of productive stock of capital but on other cases it has been addressed to building bubbles, speculation or sumptuary public investments of low or null priority.

General Government Expenditure

The percentage of General Government Expenditure on Gross Domestic Product has experienced a high increase in these OECD countries for the period 1970-2010, from around 25% to around 50%, although Public Consumption has shown a stable ratio, with oscillations, around 20%, for that period, and the ratio of public investment has usually shown a moderate evolution.

Table presents 1 presents a comparison of the ratios of Public Current Expenditure (Public Consumption and other components) and Public Investment, in years 1970-2010 in 4 countries with available data for both years.

Table 1. Ratios of General Government Expenditure to GDP, 1970 and 2011

Country	Consumption		Current		Investment		Total	
	1970	2011	1970	2011	1970	2011	1970	2011
France	0.18	0.24	0.34	0.52	0.03	0.04	0.37	0.56
Germany	0.16	0.19	0.32	0.43	0.04	0.02	0.36	0.45
Spain	0.09	0.21	0.19	0.42	0.03	0.04	0.22	0.46
UK	0.18	0.21	0.33	0.43	0.05	0.03	0.38	0.46

Source: Elaborated by M.C. Guisan from OECD National Accounts Statistics.

There has been a slight increase in the percentage of Public Consumption on GDP in the cases of France, Germany and the United Kingdom. There has been a convergence of Spain to the ratio of those countries, starting from a very low value of only 9% in year 1970. The percentage of investment has increased slightly in France and Spain and has diminished in the cases of Germany and the United Kingdom. As explained in the OECD section of Public Investment, the percentage is around 3% in the OECD. There has been an increase of the percentage of Total General Government Expenditure on GDP, partly due to the increase of Public Consumption and mainly due to the increase of Other Current Transfers (Current Expenditure less Public Consumption Expenditure).

These components are mainly transfers between social groups (people that pays taxes and people that receive subsidies) and between different moments of the time (people that pays social contributions during their working life and receive it back as pensioners). It there is an even balance between public income and public expenditure of these transfers, and they do not imply excessive taxes, they do not damage the evolution of growth and development and may contribute to increase social welfare. It they imply excessive taxes or high levels of public debt, they may have negative impact on the private sector and on economic growth and development.

The net impact of public expenditure on the economy depends of the regime of Gross Domestic Product (limited by demand, supply of primary inputs or supply of

intermediate inputs), the competition with the private sector for access to restricted credit, and the type of expenditure, as we will see in the next sections.

Table 2. Private Debt as percentage of GDP, 1995-2016

Year	France	Germany	Italy	Spain	UK	USA
1995	163.64	148.29	122.93	130.79	163.05	155.70
2000	177.84	170.94	131.32	181.18	189.14	180.96
2005	188.52	164.65	153.60	236.62	227.04	198.28
2010	217.16	157.86	184.18	268.57	229.63	204.65
2015	230.49	147.60	172.51	217.41	214.22	198.34
2016	234.00	147.70	172.59	208.24	222.67	202.04

Source. OECD National Accounts.

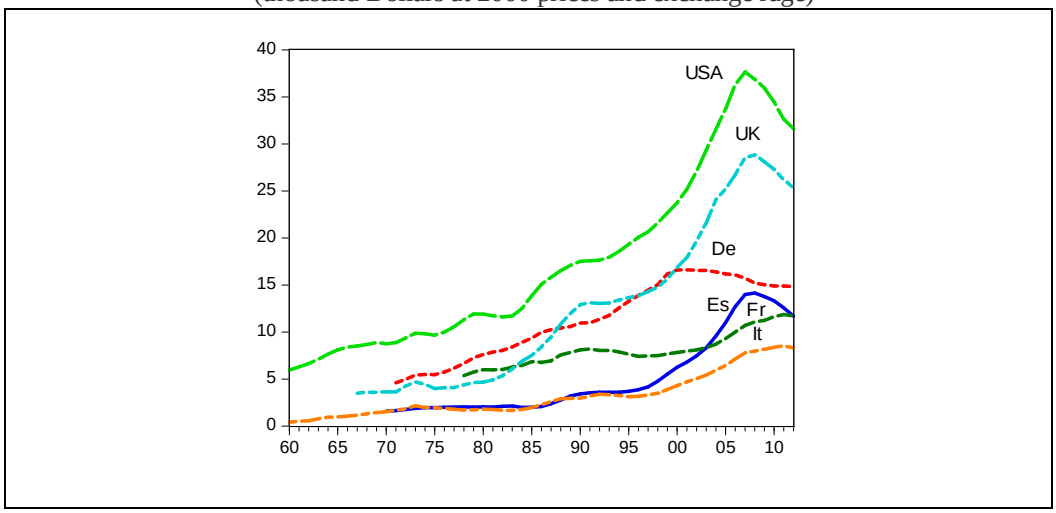
Table 3. Public Debt as percentage of GDP, 1995-2016

Year	France	Germany	Italy	Spain	UK	USA
1995	66.96	54.12	121.23	67.53	51.40	83.22
2000	72.23	59.52	118.99	65.17	48.75	61.75
2005	81.95	70.06	117.43	49.98	51.40	79.00
2010	96.98	84.47	124.87	66.56	89.22	116.99
2015	120.27	78.93	156.86	116.44	112.15	125.28
2016	123.38	76.22	155.60	116.56	121.02	127.14

Source. OECD National Accounts.

Private debt: The increase of private debt is related with family wealth and income. Countries with higher degrees of solvency have also higher levels of household debt per inhabitant, as seen in Graph 4. One of the main goals of household credit is to buy homes. The increase in private debt is usually associated with increase in private wealth, and it must be sustainable, accordingly with economic development.

Graph 4. Stock of credit to households, in France (Fr), Germany (De), Italy (It), Spain (Es), the United Kingdom (UK) and the United States (USA)
(thousand Dollars at 2000 prices and exchange rage)



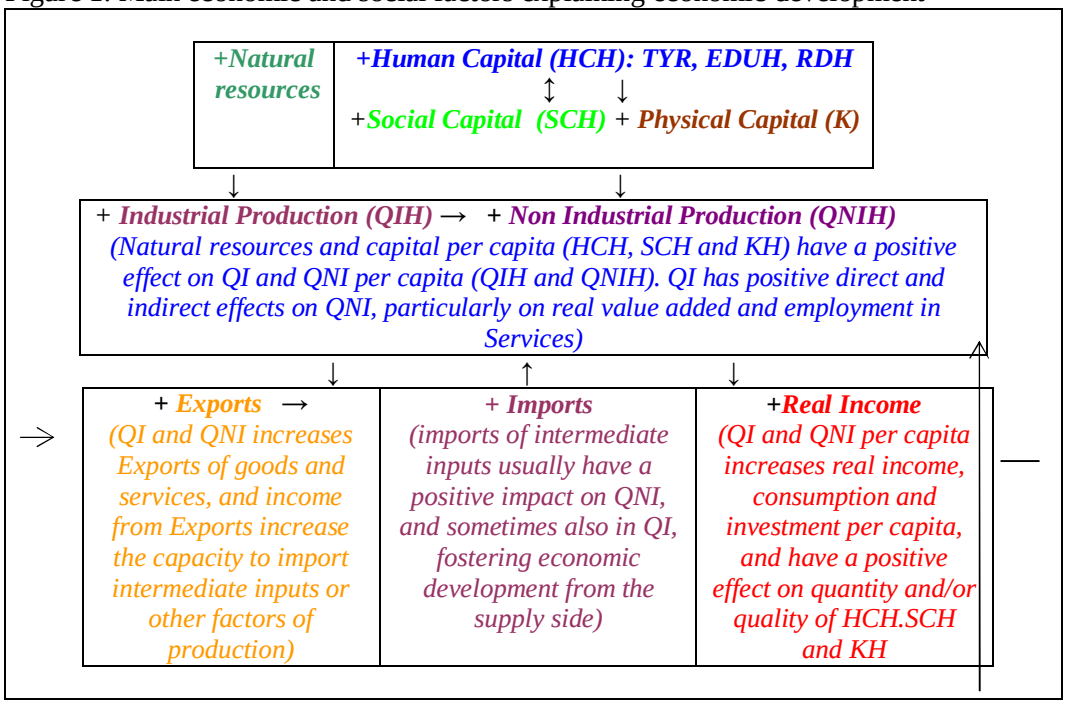
Source: Guisan(2014) from BIS statistics: stock of credit to households.

Public debt: The percentage of public debt on GDP has been increased for the period 1995-2016 in table 3. The evolution for the periods 1995-2005 and 2005-2015, has been as follows: In France the increase was 14.99 for the first period and 38.62 for the second one. In Germany, 15.99 for the first period and to 8.87 for the second one. In Italy there was a diminution of 3.8 for the first period and an increase of 35.56 for the second period. In Spain there was a diminution of 17.55 for the first period and an increase of 66.46 for the second one. In the United Kingdom there was no change for the period 1995-2005 and an increase of 60.75 for 2005-2015. In the United States there was a decrease of 4.22 for the first period and an increase of 46.28 for the second period. The economic crisis of the period 2008-2015 has contributed to increase public debt as a consequence of the difficulties to increase taxes.

3. Economic development, Government contribution and Macroeconometric models of disequilibrium

As seen in Guisan(2009) and other studies, there are many factor that contribute positively to economic growth and development (from natural resources, to human capital, from social capital to credit, from physical capital to foreign trade, and many other ones). Figure 1 shows a short version the interactions among those factors, where industrial development and foreign trade play an important role. In this section we will add some comments on the role of the Government contribution in this regard.

Figure 1. Main economic and social factors explaining economic development



Source: Guisan(2009), based in macroeconometric models analyzed in Guisan(1980), Guisan, Aguayo and Exposito(2001), Guisan(2006) and (2007) and Guisan and Neira(2006), and other sources. Human capital (HC) in the first row includes educational and research indicators: TYR is total years of schooling, EDUH and RDH are Education and Research expenditure per head.

Public sector contribution may be important regarding human capital, social capital and physical capital (infrastructures of high priority for development and welfare). Very important contributions of the public sector are those addressed to include current resources and investment in the Educational sector, because the educational level of population has a positive impact on the value of investment and production per head.

Other contributions of the public sector are the regulations addressed to foster production of industry and non-industrial activities, having into account that the non-industrial sectors depends, at a great extent, on the expansion of industry.

Government should contribute to foster demand and supply without damaging the production and income of the private sector. If expansion of public expenditure implies diminution of income and/or credit to the private sector the effects may be negative for development and welfare. It is interesting to analyze the effects in the context of a model of disequilibrium.

There are some important components of Public Consumption, as education and health, which have effects on Private Consumption, because given a level of income there is a demand for those social services that may be partly provided by the public sector and the rest provided by the private sector. As seen in Guisan and Arranz(2003) and other studies, there are some positive effects of a mix of public and private services in health and education because while public access guarantees access to all the citizens, private provision guarantees freedom of choice.

Government Expenditure in Macroeconometric models of disequilibrium

The model of disequilibrium suggested by Guisan(2013), based on Guisan(1980), (2006) and other studies, has into account not only the perspective of demand and supply of primary inputs (production function) but also the supply side of intermediate inputs, which has into account industry and the impact of foreign trade. This approach is of uppermost importance for many countries

In this approach GDP is expressed by model (4) which has into account models (1) to (3) as particular cases:

Model 1. Demand side: GDP^d = Consumption + Investment + BT (1)

Model 2. Supply of primary inputs: GDP^{s1} = Production Function= F(KA, L, t) (2)

Model 3: Supply of intemediat inputs GDP^{s2} = Sum of Production by sector (3)

Model 4. Disequilibrium: $GDP = \min (GDP^d, GDP^{s1}, GDP^{s2})$ (4)

Where

Total Consumption = Private Consumption + Government Consumption: CT=CP+CG

Total Investment = Private investment + Government Investment IT= IP + IG
Private Investment = Dwellings + Productive firms + other ones
Public Investment = Investments of high priority + Investments of low priority
BT refers to the balance of foreign trade of goods and services = (EXP-IMP)
KA = Available stock of capital
L = Employment
t = Time

The equations of the disequilibrium model are included in the Annex.

Effects of Government Consumption and Investment: The effect depends on the regime of relation (4).

Demand side: If the minimum of (4) is GDP^d, the effect of CG and IG generally will be positive on GDP and their main components (CP, IT and other variables).

Supply side of primary inputs: If the minimum of (4) is GDP^{s1} the effect of IG will be positive for production if it contributed to increase IT.

Supply of intermediate inputs: If the minimum of (4) is GDP^{s2} the effects of increases of Public Consumption and Public Investment may have little effect on economic development (depending on the type of expenditure) and may damage the level of income of private sector (families and firms), if those increases are not accompanied by other measures addressed to foster industry, exports and capacity to import and avoid unsustainable foreign trade deficits.

When the restrictions comes from the supply side, the expansion of public sector with no priority expenditures (current expenditure or investment) may damage the levels of real income of families and enterprises. The proposals of the European Union in year 2018 to increase public investment as a means to foster development, will not work if the main restriction to development (due to the stagnation or diminution of industry in many countries), and it may damage the family incomes and the access to credit of the private sector.

Delocalization of industry with investment in foreign markets diminish domestic production of non industrial sectors and employment, both in industrial and non-industrial sectors, but has as a positive outcome the increase of incomes from abroad and them it allows to increase the capacity to Import and may suppose increases of consumption and investment, ,of those incomes in the domestic market.

The evolution of the economic policies of European Union, for the period 2008-2016, has not had into account many of the main explanations of economic development of our model of disequilibrium, and has caused stagnation or decrease of real production, income and employment in several European countries, and thus it has received very strong criticisms, as seen in Guisan and Exposito(2018). The excess of restrictions to family income and credit not only has not helped to avoid the problem of decay of industrial production but it has decreased the domestic demand and had a negative impact on industrial production in several countries

In the Annex we include some econometric estimations and graphs that show the negative consequences of the austerity policies of the European Union.

Regarding developing countries the levels of consumption expenditure and government expenditure are usually very low and it is desirable to foster economic development in order to allow higher levels of government income without damaging private consumption and investment. In Guisan((2017) we present an evaluation of manufacturing and development in 132 countries for the period 2000-2015.

Private and public debt usually increase with the level of solvency given by higher levels of economic development.

4. Conclusions

The economic experience of the six OECD developed countries of this study show that public consumption and public expenditure usually increase their ratio con Gross Domestic Product, and their real values per capita, with economic development. This is compatible with important increases of private consumption and investment, if some rational limitations are hold within the perspective of models of disequilibrium that have into account the evolution of demand and supply.

For developed countries the most important conclusion is that excessive austerity policies, with diminution of real income family, as those imposed by the European Union in several countries for the period 2008-2018, damage the evolution of economic development and causes citizens distress. The proposal from the European Union to expand public investment in order to foster development, are not good if they are not accompanied by other measures, within the disequilibrium approach, to avoid damages to private consumption and public consumption.

For developing countries it is important to foster the educational level of population, industry and economic development, from the supply sides, in order to reach higher levels of production per head and expand their demand capacity, both from the private sector and from the public sector.

Bibliography

Arrous, J.(1999). *Les théories de la croissance. La pensée économique contemporaine (3)*. Éditions du Seuil, Paris.

Ball, (1977) *Models of Project Link*. North-Holland, Amsterdam.

Barro, R.J., Grossman, H.I. (1971). A General Disequilibrium Model for Income and Employment. *American Economic Review*, Vol.71-1, pp.82-93.

Barro, R.J.(1991). Economic Growth: A Cross-section of Countries. *The Quarterly Journal of Economics*, pp. 407-443.

Bodkin,R.G., Klein,L.R., Marwah,K.(1991).*A History of Macroeconometric Model-Building.*Aldershot.

Fair, R.C. (1994). Testing Macroeconometric Models. Harvard University Press.

Frias, I.(2013). "Oil Price Shocks and The Business Cycle in Spain: Is The 2008 Financial Crisis Different?", *Applied Econometrics and International Development* Vol. 13-2, pp.45-56.

Guisan, M.C.(1980). "Forecasting Employment through an international Cobb-Douglas Function". 4th Econometric Society World Congress, Aix-en-Provence.

Guisan, M.C. (2004). "A Comparison of Causality Tests Applied to the Bilateral Relationship between Consumption and GDP in the USA and Mexico", *International Journal of Applied Econometrics and Quantitative Studies*, Vol. 1-1. On line at Ideas.Repec.

Guisan, M.C. (2006). "Industry, Foreign Trade and Development: Econometric Models of Europe and North America, 1965-2003", *International Journal of Applied Econometrics and Quantitative Studies*, Vol. 4-1.

Guisan, M.C. (2007). "Industry, Foreign Trade and Development: Econometric Models of Africa, Asia and Latin America 1965-2003", *International Journal of Applied Econometrics and Quantitative Studies*, Vol. 5-1.

Guisan, M.C. (2009). "Government Effectiveness, Education, Economic Development and Well-being: Analysis of European Countries in Comparison with the United States and Canada. Applied Econometrics and International Development, Vol. 9-1.

Guisán, M.C.(2010). Desarrollo económico mundial en 2000-2010: Análisis de la OCDE, América Latina, África y Asia, *Estudios Económicos de Desarrollo Internacional*, Vol. 10-2.

Guisan, M.C. (2011 a) "Industry, Fair Competition and Trade in OECD Countries: Impact on Wages and on Employment by sector 2000-2010". *Regional and Sectoral Economic Studies*, 11-2.

Guisan, M.C. (2011 b). "Industry, Foreign Trade and Employment in EU Countries: Comparison of France, Germany, Italy, Spain and the UK with the United States". *Applied Econometrics and International Development* Vol. 11-2.

Guisan, M.C.(2013). "Macro-Econometric Models of Supply and Demand: Industry, Trade and Wages in 6 Countries, 1960-2012", *Applied Econometrics and International Development*, Vol. 13.2, on line at: http://www.usc.es/econo met/aeid.htm

Guisan, M.C. (2017). Manufacturing And Economic Development In The World For 2000-2015: Main Features And Challenges, *Revista Galega de Economia* Vol. 26-3, on line at Ideas.Repec

Guisan, M.C., Aguayo, E., Exposito, P.(2001). Economic Growth and Cycles: Cross-country Models of Education, Industry and Fertility and International Comparisons. *Applied Econometrics and International Development* Vol. 1-1, pp. 9-37.

Guisan, M.C., Arranz, M. (2003). Econometric Models of Private and Public Health Expenditure in OECD countries, 1970-96. *Applied Econometrics and International Development, Vol. 3-3*.

Guisan, M.C., Cancelo, M.T. (2001). "Supply and Demand of Manufacturing Output in OECD Countries. Econometric Models and Specification Tests". *Applied Econometrics and International Development* Vol.1-2, pp.7-42.

Kaldor, N. (1977). "Capitalism and industrial development: some lessons from Britain's experience". *Cambridge Journal of Economics*, Vol. 2-1, 193-204. 1st published in Spanish 1976.

Klein, L.R.(1983). *The Economics of Supply and Demand*. Basil Blackwell, Oxford.

Sneesens, H.R., Dreze, J.H. (1986). "A Discussion of Belgian unemployment, combining traditional concepts and disequilibrium econometrics." *Economica* 53: Suplement 89-119.

Temple,J.(1999). "The New Growth Evidence", Journal of Economic Literature,Vol.27,p.112.

Valadkhani, A. (2005). "Macroeconometric Modelling: Approaches and Experiences in Development Countries", *Applied Econometrics and International Development*, V.5-1, pp.5-24

Annex on line at the journal Website: http://www.usc.es/econo met/eaat.htm

Annex (to be updated in September of 2018)

Table A1 presents the list of variables of table 4 of Guisan(2013), with some small changes in order to show the effects of Government expenditure

Table 2. Endogenous variables of Models 1 to 3 (demand and supply models)

Group	Name	*Explanation*
Consumption, Investment, Production	C	*Private Consumption (CP), Public Consumption (CG)*
	I	*Investment. Gross Fixed Capital Formation (GFCF)*
	IS	*Gross Capital Formation=GFCF+VS (VS:variation stocks)*
	Q	*Gross Domestic Product (by sector: QA, QI, QB, QS)*
	FAMI	*Family Income (net of taxes)*
Trade, Financial facilities	Imp	*Imports= Impg (goods)+ Imps (services)*
	Exp	*Exports=Expg (goods) +Exps (services)*
	CFin	*Credit Financing families (CFin1), firms (CFin2), both (CFIN3), **Credit Financing Government (CFIN4), All credit (CFIN5)***
	Cimpg	*Capacity to finance Imports of goods*
Labour, Capital, Productivity, Wages	L, L*	*Labour (actual and desired level by firms and institutions)*
	KA	*Stock of physical capital (available)*
	PA	*Population with Activity*
	PM	*Productivity of Labour, mean*
	W	*Wage: average compensation of employees per employee*

Note: New variables in this version of 2018, expanding the model by Guisan(2013), indicated in in blue colour: CG, CFIN4, CFIN5, FAMI.

Model 1: Demand side model for Q^d

(1a) $Q_t^d = CP_t + CG_t + IS_t + EXP_t - IMP_t$	*(6) $W_t = f(W_{t-1}, D(PM_t))$*
(2a) $L_t = f(L_{t-1}, D(L^*_t), D(PA_t))$; $L^*_t = f(Q,KA,t)$	*(7) $D(W_t) = W_t - W_{t-1}$*
(3.1) CP_t = f(D(FAMI), D(CFIN1), CP_{t-1})	*(8) $D(PM_t) = PM_t - PM_{t-1}$*
(3.2) CP_t = f(D(Q), D(Taxes), D(CFIN4), CP_{t-1})	*CFIN1=CFIN6-CFIN2-CFIN4)*
(4) $IS_t = f(D(Q_t), D(CFIN2), IS_{t-1})$	*(9) $PM_t = Qt/L_t$*
(5) $D(Q_t) = Q_t - Q_{t-1}$	*(10) FAMI=f(Production (+),Taxes(-)*

Note: new equations (3.1) and (3.2) in substitution of equation (3) of Guisan(2013)
(3) C_t = f(D(Q_t), D(CFIN1) C_{t-1}), and (10) Famili Income.

Model 2. Supply of primary inputs (labour and stock of capital): $Q_t = Q_t^{s1}$

(1 b) $Q_t^{s1} = f(KA_t, L_t, t)$	*(7) $D(W_t) = W_t - W_{t-1}$*
(2 b) $L_t = L_t = f(L_{t-1}, D(L^{**}_t), D(PA_t))$; $L^* = f(Q_t/W_t)$	*(8) $D(PM_t) = PM_t - PM_{t-1}$*
(3-1) and (3-2): Z_t and C_t	*(9) $PM_t = Qt/L_t$*
(4) $IS_t = f(D(Q_t), D(CFIN2), IS_{t-1})$	*(10) $KA_t = KA_{t-1} + I_{t-1} - A_{t-1}$*
(5) $D(Q_t) = Q_t - Q_{t-1}$	*(11) $I_t = IS_t - VS_t$*
(6) $W_t = f(W_{t-1}, D(PM_t))$	

Model 3. Supply of intermediate inputs and foreign trade (Guisán(1980), (2001) and (200)

(1 c) $Q^{s2}_t = QA_t + QI_t + QB_t + QS_t$	*(10)* $KA_t = KA_{t-1} + I_{t-1} - A_{t-1}$
(2 c) $L_t = f(L_{t-1}, D(L^*_t), D(PA_t))$; $L^*=f(Q_t/W_t, KA_t/W_t)$	*(11)* $I_t = IS_t - VS_t$
(3-1) and (3-2): Z_t and C_t	*(12)* $QB_t = f(QB_{t-1}, D(QS_t), D(IMPG_t), D(EXPG_t)$
(4) $IS_t = f(D(Q_t), D(CFIN2), IS_{t-1})$	*(13)* $QS_t = f(QS_{t-1}, D(QI), D(IMPG_t), D(EXPG_t)$
(5) $D(Q_t) = Q_t - Q_{t-1}$	*(14)* $IMPG_t = f(IMPG_{t-1}), D(CIMPG), D(C_t)$
(6) $W_t = f(W_{t-1}, D(PM_t))$	*(15)* $CIMPG_t = EXPG_t + EXPS_t - IMPS_t + CFIN3$
(7) $D(W_t) = W_t - W_{t-1}$	*(16)* $EXPG_t = F(EXPG_{t-1}, D(QI_t)$, *Otros Factores)*
(8) $D(PM_t) = PM_t - PM_{t-1}$	*(17) a 21): Identities for*
(9) $PM_t = Qt/L_t$	*D(QS), D(IMPG), D(EXPG), D(QI), D(CIMPG).*

Note: in equation (13) it is, usually, convenient to include the current value of $D(QI_t)$, although in order to simplify the model, avoiding interdependence, sometimes it is substituted by its lagged value: $D(QI_{t-1})$.