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LUXEMBOURG

SELECTED ISSUES

April 2018

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LUXEMBOURG

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March 16, 2018

Approved By
European Department

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IMPACT OF MONETARY POLICY ON LUXEMBOURG[1]

Accommodative monetary policy has contributed to the performance of the Luxembourg economy through some expansion of aggregate demand and through its impact on the financial system. Banks have remained profitable and interest margins stable, while fee and commission income from fund and other activity has been healthy. The investment fund industry has benefited from various factors such as portfolio rebalancing, search for yield, and other market developments leading to strong inflows into various classes of investment funds, and through strong valuation effects. Scenario analysis suggest that the fund industry could be adversely impacted by sharp interest rate increases and that, because of interconnections, the banking system would also be affected. Margins of some banks could also decline when interest rate normalize. Against this backdrop, it is important to implement all 2017 FSAP recommendations that will contribute to making the financial system more resilient to shocks, including those arising from faster-than-expected monetary policy normalization.

A. Introduction

1. Monetary policy has been in exceptional territory since the global financial crisis, thereby supporting aggregate demand. While short-term interest rates reached the lower bound, various unconventional monetary policies were implemented by the ECB and by the Federal Reserve System (Fed), including long-term refinancing operations, asset purchase programs, outright monetary transactions, negative interest rates on the deposit facility driving short-term rates into negative territory, and novel communication tools such as forward guidance.

2. Performance of the Luxembourg financial sector has been generally strong. The strong growth of the investments fund industry has generated income for the financial sector at large, including banks through higher fee and commission income, and stimulated ancillary service activities, in particular administrative and depository services. Meanwhile, there is no evidence that banks have compressed their lending margins as lower funding costs were passed on to retail borrowers and corporates. Meanwhile the private banking industry has attracted new high net worth clients to whom specific services, including mortgage loans, are offered.

3. Accommodative monetary policy and search for yield have contributed to the rapid expansion of the Luxembourg investment fund industry. In addition to a reduction in bank intermediation since the financial crisis, QE and low interest rate policy have fueled the expansion of the fund industry through:

- Abundant liquidity and a global search for yield, creating demand for assets offering higher yields than traditional bank savings instruments;
- Relative expansion of investment funds into riskier assets (high yield bonds, emerging market bonds, equity), including as a result of portfolio rebalancing; and:
- Rich valuation effects, notably in stock markets.

[1] Prepared by Thierry Tressel (EUR).

4. This chapter is organized as follows. First, it provides an overview of the impact of monetary policy on Luxembourg's macroeconomy. Second, it analyzes the impact on the banking system, including risks that could result from normalization. Third, it studies the impact of accommodative monetary policy on the investment fund industry. Fourth, it concludes.

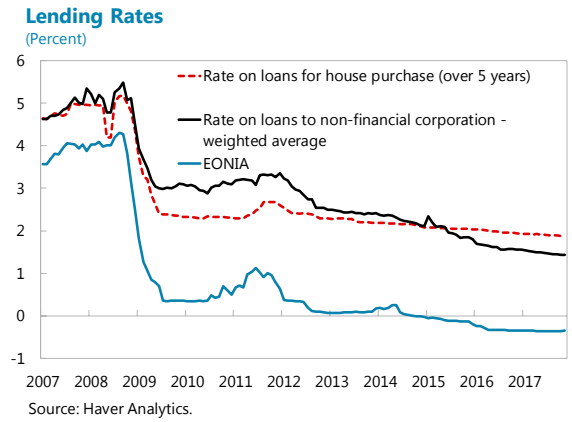
B. Macroeconomic Impact of Monetary Policy in Luxembourg

5. Easing of monetary policy impacts the macroeconomy through various channels. An easing of monetary policy leads to a decrease in real interest rates, which lowers the cost of borrowing resulting in greater investment spending and consumption, thus affecting saving-investment decisions, and increasing aggregate demand. Asset prices such as stock market valuations tend to increase, which affects financial wealth and consumer spending; balance sheet effects through collateral valuations also tend to facilitate borrowing. Easing of monetary policy stimulates credit supply as banks' cost of capital declines. By affecting asset prices (or through direct asset purchases), monetary policy may trigger portfolio rebalancing toward riskier assets. Last, easing of monetary policy can trigger more risk taking as banks loosen their lending standards, and investors step up search for yield. The effects of portfolio rebalancing (from safe financial assets to more risky investment funds) and search for yield are relevant for Luxembourg's investment fund industry.

6. There is evidence that banks passed on the lower nominal interest rates to households and firms (Figure 1). Luxembourg banks have passed on lower interest rates to their retail and corporate borrowers. Lending rates have stabilized around or slightly below 2 percent. In the meantime, core inflation fell to 1 percent in 2016, but started to rise more recently broadly in line with euro area developments. Deposit rates also fell, particularly so for corporates.

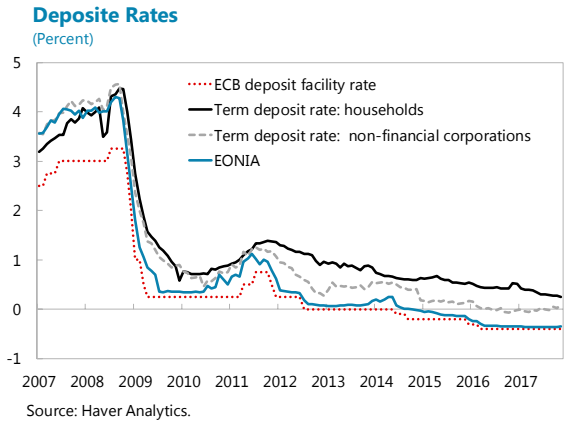
Figure 1. Impact of Monetary Policy on Interest Rates in Luxembourg

Lending rates fell …



Source: Haver Analytics.

… as well as deposit rates.



Source: Haver Analytics.

7. Households may have benefitted from wealth effects, particularly home owners, as a result of continuously rising housing prices (see Chapter II). According to the 2014 Household Finance and Consumption Survey of the *Banque centrale du Luxembourg* (BcL), real estate amounts to about 80 percent of household wealth on average, and about 1/3 of total real estate wealth is for investment purposes. Bank deposits account for about 50 percent of financial wealth, suggesting that lower income households may have benefitted much less from potential wealth effects of accommodative monetary policy.

Mean Household Wealth by Category

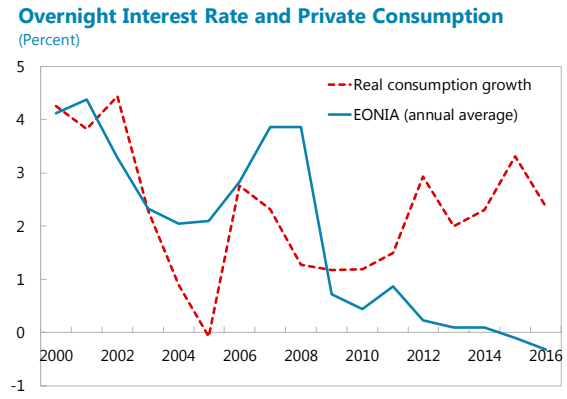
(in thousands euros)	2010	2014
Real estate: main residence	410.6	438.0
Other real estate	239.3	233.2
Deposits	38.7	61.3
Mutual funds	18.1	20.9
Voluntary Pensions / Life Insurance	16.8	23.4
Other financial assets	14.8	26.8

Source: BCL household survey 2014

8. Private consumption has risen somewhat, in particular since 2011 (Figure 2). However, it remains volatile, making it difficult to identify a clear trend. While there is no clear evidence of an acceleration of new mortgage credit, debt servicing costs have declined for the stock of existing mortgages at floating interest rates. This should have contributed to stimulating consumption. However, for prospective home-owners, in particular younger households, a rising affordability problem may on the other hand have contributed to moderating consumption.

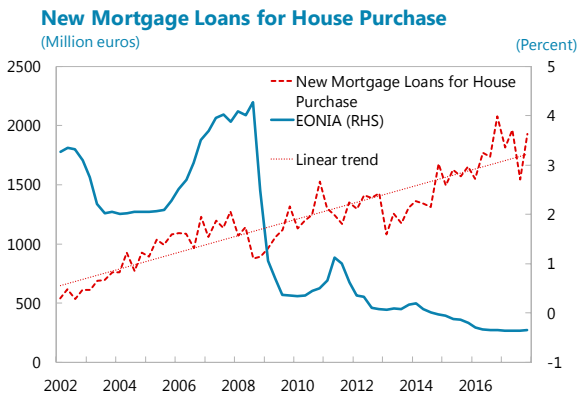
Figure 2. Accommodative Monetary Policy and Private Consumption

Consumption has moderately risen …



Source: Haver Analytics.

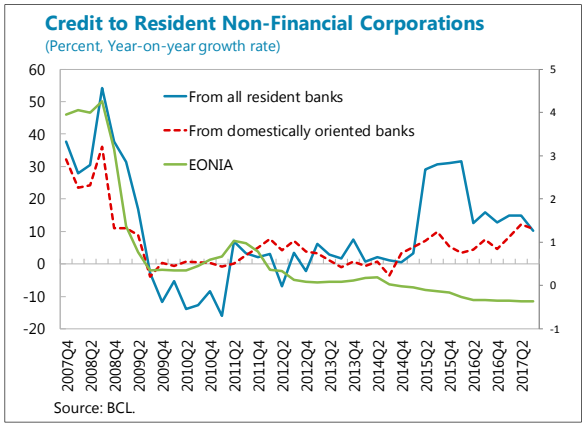
… while mortgage credit has continued to grow around a stable trend.



Source: Banque Centrale du Luxembourg.

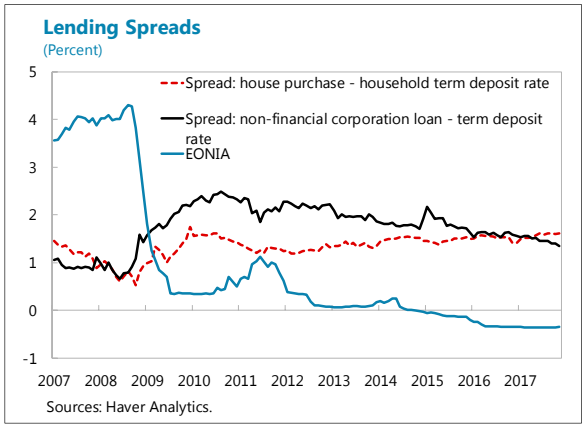
9. Bank credit to non-financial corporations appears to be rising, but statistical issues make interpretation difficult. Credit to resident non-financial corporations has been traditionally very volatile, perhaps due to the small number of large firms in Luxembourg. Some statistical issues, however, complicate the analysis. In 2015, a break in the series arose as a result of a reclassification

of one firm from the category "other financial institutions" to "non-financial corporations". In addition, the recent acceleration of lending to non-financial corporations by domestically oriented banks may partly be driven by borrowing by multinationals which could be used to fund activities of foreign subsidiaries.



C. Impact of Monetary Policy on the Banking System

10. Luxembourg banks have withstood the low interest environment well and protected their lending spreads (Figure 3). The four large domestically oriented banks have somewhat better profit performance than European banks on average. They have passed on lower rates to domestic borrowers but lending spreads have remained broadly constant and nonperforming loans (NPLs) low, and so their net interest margins have remained stable since the global financial crisis, slightly above the EU average. Operating costs have remained below the European average.



11. In general, the banking system has performed relatively well since monetary policy became accommodative. Fee and commission income of the banking system have benefited from various activities such as those related to the investment fund industry. There is limited evidence that low interest rates have contributed to balance sheet expansion by lifting the demand for mortgages, as new mortgages have continued to grow along a broadly constant trend despite declining rates, perhaps because of housing supply constraints. Other activities such as private banking have been healthy.

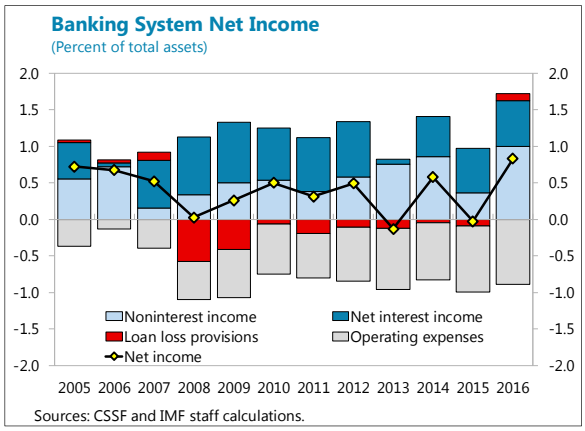
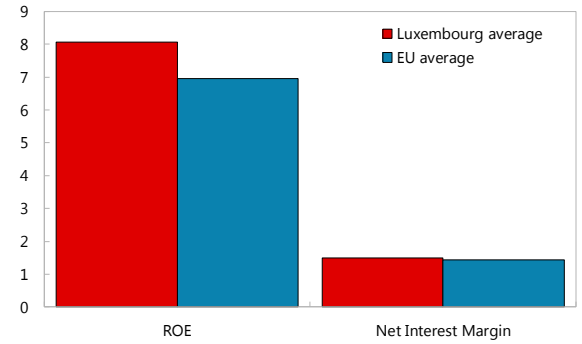


Figure 3. Domestically Oriented Banks' Performance

Luxembourg banks are relatively profitable …

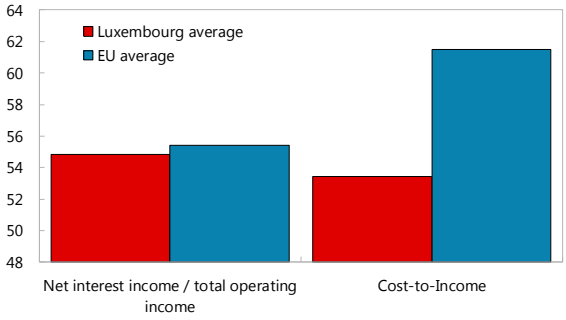
Profitability Indicators - Domestically oriented banks (2016)
(Percent)



Sources: SNL, European Banking Authority, and Detragiache, Tressel and Turk (2017).

…have diversified income and are cost efficient.

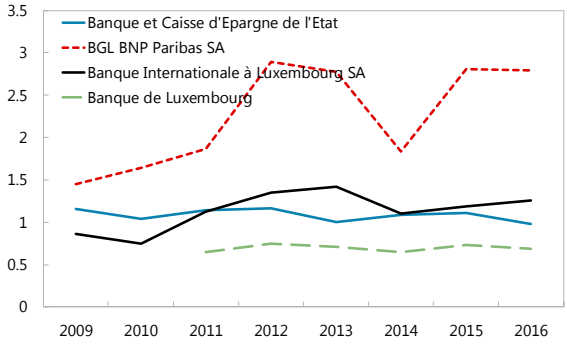
Profit composition and cost performance - Domestically oriented banks (2016)
(Percent)



Sources: SNL, European Banking Authority, and Detragiache, Tressel and Turk (2017).

Net interest margins have remained stable or even increased …

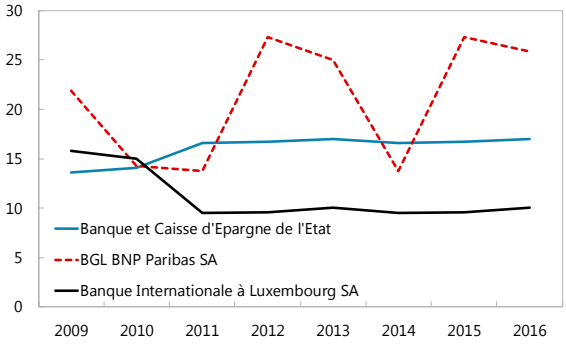
Net Interest Margin
(Percent)



Source: SNL.

… and banks preserved their customer base.

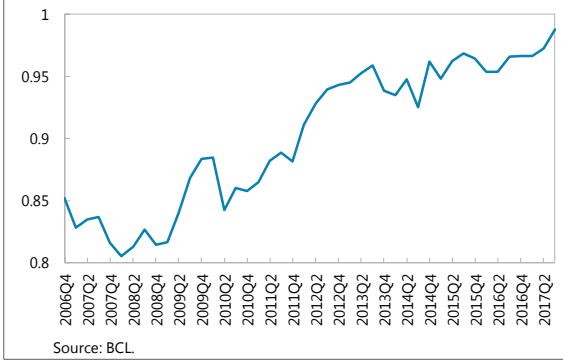
Net Customer Loans
(Billions of euros)



Source: SNL.

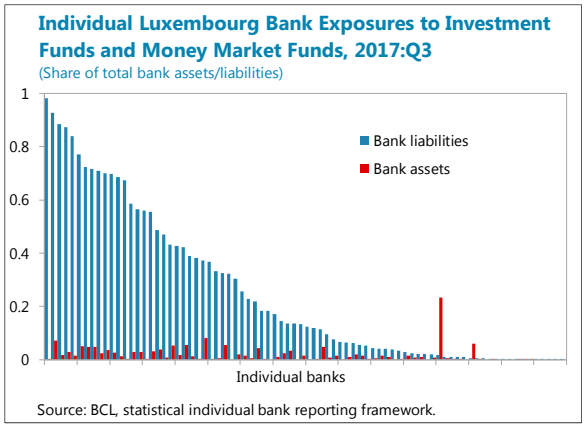
12. Going forward, the normalization of interest rates could affect some domestic banks. The growing share of fixed rate mortgages in the new loan production relative to historical practices could expose the domestically oriented banks active in real estate lending to some compression of margins that would materialize when monetary policy normalizes (see Chapter 2). Credit risk could result from highly indebted households who financed real estate purchases with mortgages at floating interest rates (see Chapter 2). Last, balance sheet liquidity mismatches are limited given that the ratio of mortgage loans to retail (household) deposits remains below 100 percent.

Ratio of Loans to Households / Household Deposits, in Domestically Oriented Banks



Source: BCL.

13. The Luxembourg banking system has become more interconnected domestically and globally, making it susceptible to external shocks that could result from sharp interest rate increases (see next section). According to sectoral financial accounts, in the three years to June 2017, liabilities of Luxembourg monetary and financial institutions (MFIs) to domestic sectors have grown by €125 billion, about 2.5 times 2016 GDP, reaching €395 billion. MFIs have become more connected among themselves, with local offices of multinational firms ("other financial institutions") and with investment funds. During the same period, investment funds' liabilities have increased by about €1 trillion, while total gross liabilities of the sector "other financial institutions" (which includes various entities conducting international Treasury operations) vis-à-vis all domestic sectors (including itself) and the rest of the world have increased by about €4 trillion. Linkages between local custodian banks and investment funds, both from deposits and derivative contracts, remain significant.



Interlinkages Among Institutional Sectors in Luxembourg, June 2017
(In billions of euros)

			Liabilities of:										
			Domestic sectors										
			Non-financial corporations	MFIs (excl. MMFs)	MMFs	Non-MMF investment funds	Other financial institutions	Insurance and pension funds	General government	Households [1/]	Rest of World	Unidentified	Total
Assets of:	Domestic sectors	Non-financial corporations	53.4	16.7	-	0.4	208.0	0.4	1.7	-	202.6	-	483.1
		MFIs (excl. MMFs)	25.5	130.0	1.0	6.9	30.9	0.5	6.5	31.9	737.4	-	970.6
		MMFs	0.3	6.5	5.1	-	1.1	-	-	-	276.5	-	289.4
		Non-MMF investment funds	17.7	108.4	12.9	431.5	88.2	0.0	0.2	0.0	3,421.6	-	4,080.5
		Other financial institutions	317.4	68.3	0.6	21.6	2,775.9	4.7	0.5	0.0	5,952.4	-	9,141.3
		Insurance and pension funds	2.3	9.6	1.6	38.6	2.6	3.7	0.3	0.0	131.8	-	190.4
		General government	7.1	15.3	-	0.3	0.0	0.1	1.0	0.1	20.3	-	44.2
		Households [1/]	7.3	40.3	0.2	8.7	0.6	11.4	0.1	0.5	24.7	-	93.8
		Rest of World	175.7	572.7	268.1	3,576.8	6,035.8	173.4	7.2	1.8	-	-	10,811.5
		Total	606.6	967.7	289.4	4,084.7	9,143.1	194.1	17.5	34.2	9,775.6	-	**26,104.8**

Sources: Total assets and liabilities are from BCL Table 05.08 and bilateral sectoral accounts are from dataset General FSAP questionnaire "10a_Luxembourg_General Data FSIs Table 10 LU-Rest_world"

[1/] *Includes households and non-profit institutions serving households.*

D. Impact of Monetary Policy on the Investment Fund Industry

Event Study

14. Since the global financial crisis, the ECB and the Fed have announced many unconventional monetary policy decisions. The table below summarizes the month of main announcements by the ECB and the Fed regarding unconventional monetary decisions as well as, in the case of the Fed, communications regarding exit from QE or interest rate normalization (Table 1).

Table 1. Luxembourg: Monetary Policy Announcements

US Federal Reserve	European Central Bank
Dec 2008-Mar 2010: QE 1	July 2009: Covered bond purchase program 1, ended June 2010
Nov 2010: QE2 starts	May 2010: SMP - 88 bil - terminated Sept 2012
June 2011: QE2 stops	Nov 2011: CBPP2. Terminated Oct 2012
Sept 2011-Dec 2012: Operation Twist	Dec 2011: LTRO announced
Sept 2012: QE3 starts	July 2012: Draghi "whatever it takes" speech
May 2013: "Tapering talk"	Sept 2012: OMT
Aug 2013: Fed keeps QE	June 2014: TLTRO I
Oct 2014: QE3 purchases end	Aug 2014: Draghi speech at JH
July 2015: communications on interest rates normalization	Jan 2015: Expanded Asset Purchase Program (APP) announced
Sept 2017: QE reversal	Mar 2015: Public sector purchase program (PSPP)
	Mar 2016: TLTRO II
	June 2016: Corporate sector purchase program (CSPP)

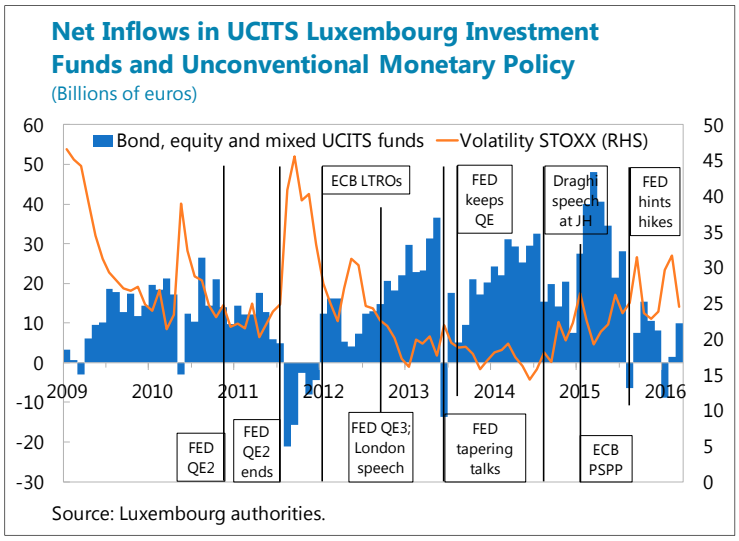
Sources: Federal Reserve and ECB.

15. Event study analysis suggests that monetary policy announcements impacted the patterns of aggregate net inflows into various types of Luxembourg investment funds.[2] The impact of monetary policy announcements on the change in net flow patterns is visible for the entire sample of bond, equity and mixed UCITS funds.[3] For example:

- *End of QE2 by the Federal Reserve in June 2011:* Shortly after QE2 ended, net flows into investment funds turned negative until the end of 2011. There was a sharp volatility of stock market indices during this period.
- *ECB Long-term refinancing operation (LTRO):* the December 2011 LTRO was followed by a reversal of net flows, from a monthly average of about -€10 billion in the last five months of 2011 to +€10 billion in the following 5 months.
- *ECB announcement of the PSPP:* The March 2015 announcement which came after the earlier APP announcement was followed by a clear increase in aggregate net inflows into investment funds, which reached about €34 billion on average until July 2015, despite a moderate increase in market volatility (compared to a monthly average of €18 billion during the last 6 months of 2014).
- *Fed communications of interest rate normalization:* Communication about interest rate normalization by the Feb started in July 2015. Average monthly net inflows dropped sharply to on average €4.8 billion until March 2016.

[2] Monetary policy announcements are not exogenous as they sometimes were a reaction to market events. It is however notable that a number of these announcements were followed by reversals in the patterns of net investment flows.

[3] During 2017, flows into Luxembourg investment funds were substantial while the ECB continued QE and the Feb very gradually started to normalize monetary policy.



16. Different monetary policy announcements impacted investment funds differently according to their investment policy. While the ECB LTRO seemed to have mostly impacted net inflows into bond funds, equity funds and to a lesser extent mixed funds (which invest in bonds and equity) were more positively impacted by the London speech by Draghi and the QE3 announcement by the Fed. The PSPP announcement seems to have impacted all categories of funds, while the start of the Fed communication on interest rate normalization triggered net outflows mostly among bond funds. As shown in the left-hand chart of Figure 4 showing absolute net flows into different bond funds, the response for advanced economies corporate bond funds was generally stronger than for emerging market bond funds or for high yield bond funds. However, the relative expansion of emerging bond funds and of high yield bond funds was much stronger than of more standard corporate bond funds as unconventional monetary policies were implemented after the global financial crisis.

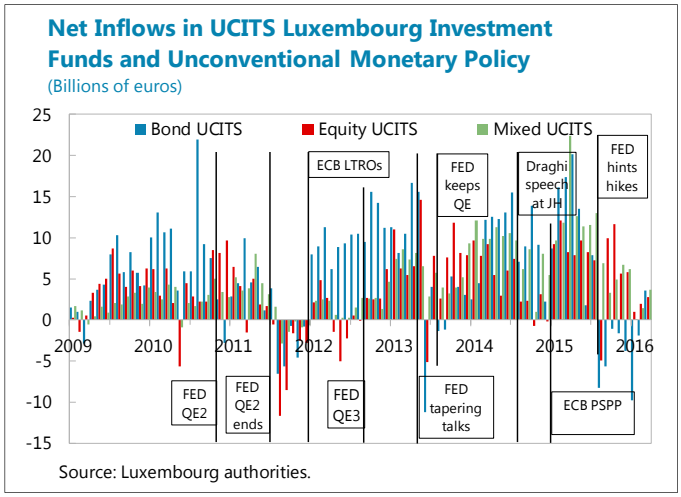
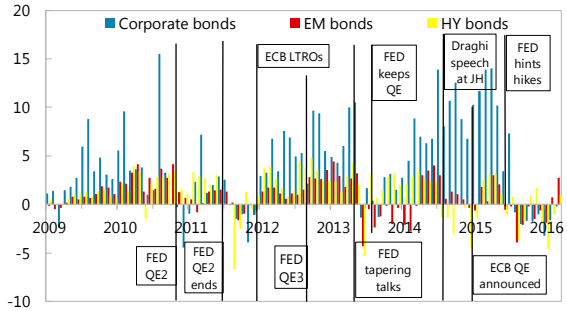


Figure 4. Evolution of Different Classes of Bond Funds

Net inflows responded differently across various investment policies of bond funds.

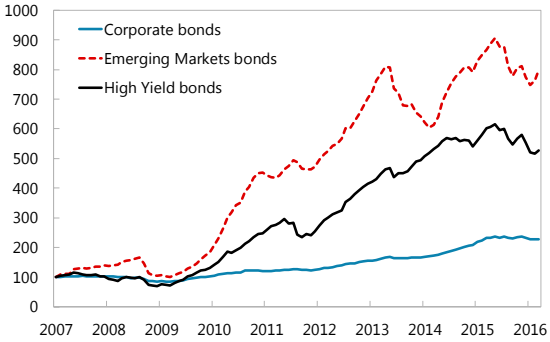
Net Inflows in Select Luxembourg Bond Funds and Unconventional Monetary Policy
(Billions of euros)



Source: Luxembourg authorities.

High yield bond funds and emerging bond funds have experienced the strongest expansion during the past decade.

Net Asset Value of Different Classes of Bond Funds
(Index 100=Jan 2007)



Source: Luxembourg authorities.

Econometric Analysis

17. We perform a regression analysis to assess investment funds' response to monetary policy conditions (Box I). The time series regression analysis is performed on data at a monthly frequency over the period 2007:M1 to 2016:M6. The two dependent variables are investment funds' net inflows and gross outflows (capturing aggregate redemptions by fund type), both expressed as a share of the previous month's net investment fund asset value. The proxy for monetary conditions is the EONIA. We control for various indicators of market conditions, indicators of real economy performance, and for the previous period's investment fund flows considered.

18. Net inflows into investment funds are significantly impacted by short-term interest rates (Table 2). An increase in the EONIA is significantly associated with a decline of net inflows into investment funds. The effect is significant for bond funds, the subcategory of corporate bond funds, and for equity funds. In decreasing order of magnitude, the effect is larger for corporate bond funds, equity funds and aggregate bond funds (see paragraph 20 for a quantification). The larger coefficients obtained for equity funds and corporate bond funds relative to the coefficient for aggregate bond funds offers some suggestive evidence of a search for yield among investors, whereby a more accommodative monetary policy is associated with a rebalancing of portfolios toward more risky investments. It is also quite notable that the coefficient remains statistically significant after we control for possible sluggishness of investment funds' flows with a lagged dependent variable, for market conditions and for real economy performance.[4]

[4] In unreported regressions, we control only for the lagged dependent variables. We find that the coefficients on the EONIA are 50–100 percent larger in absolute value without market indicators, which suggests that part of the effect of monetary policy may be transmitted through market conditions.

Box 1. Econometric Model

We estimate a econometric model linking investment fund flows to monetary conditions, global market and real economy developments as follows:

$$\Delta inflow_{it} = \alpha_i + \delta_i \cdot EONIA_t + \sum_v \gamma_{iv} \cdot Y_{vt-l} + \beta_i \cdot \Delta inflow_{it-1} + \varepsilon_t \qquad (1)$$

Where $\Delta inflow_{it}$ is either net inflows or gross outflows into/out of an aggregate category of investment funds i during month t, expressed as a ratio to the previous month's net asset value of the fund category i. We consider three categories of funds: (i) UCITS bond funds, (ii) UCITS equity funds and (iii) UCTIS bond funds with a strategy centered on corporate bonds.

The explanatory variables are: (i) the monthly average of the euro overnight market rate (EONIA), (ii) a vector of control variables Y_{vt-l} at various lags l which include the growth rate of the monthly average of the eurostoxx index, the monthly average of the stoxx50 volatility index, the growth rate of the industrial production index for the euro area, and the growth rate of the industrial production index of the U.S. We also include a lagged dependent variable $\Delta inflow_{it-1}$.

The econometric model is estimated with Newey West standard errors computed by allowing an autocorrelated structure of the residual ε_t with up to four lags.

Table 2. Luxembourg Impact of Short-Term Interest Rates on Net Inflows into Investment Funds

Dependent Variable: Net inflows	(1) Bond UCITS	(2) Equity UCITS	(3) Corporate bond
Lagged Dependent Variable	0.434***	0.271*	0.323***
EONIA	**-0.00130****	**-0.00178*****	**-0.00192*****
Growth Euro STOXX (t-1)	0.0971***	0.102***	0.0439*
Growth Euro STOXX	-0.0179	-0.0313*	-0.00369
STOXX50 volatility	-5.77e-05	-9.51e-05	-0.000197
Growth Industrial Prod EA (t-1)	-0.0394	0.0720	-0.0712
Growth Industrial Prod US (t-1)	0.260	-0.0859	0.230
Constant	0.00686*	0.00729**	0.0108**
Observations	109	109	109

Notes: Robust standard errors. ***, ** and * denote significant at 1%, 5% and 10% respectively.

19. The impact of monetary conditions on net flows is to a significant extent realized through a correlated response of aggregate redemptions to interest rates (Table 3). We find that higher short-term interest rates are associated with larger aggregate redemptions from all three categories of investment funds, and that the effects are of broadly the same order of magnitude, though they are somewhat larger for corporate bond funds. Aggregate redemptions are also positively associated with a decline in market performance and by higher financial market volatility.[5]

Table 3. Luxembourg: Impact of Short-Term Interest Rates on Redemptions from Investment Funds

Dependent Variable: Redemptions	(1) Bond UCITS	(2) Equity UCITS	(3) Corporate bond
Lagged Dependent Variable	-0.0329	-0.0163	-0.0238
EONIA	**0.00559*** **	**0.00488*** **	**0.00635*** **
Growth Euro STOXX (t-1)	-0.0674**	-0.0454***	-0.0442
Growth Euro STOXX	0.0434**	0.0402**	0.0472**
STOXX50 volatility	0.000679***	0.000210*	0.000731***
Growth Industrial Prod EA (t-1)	0.113	0.0953	0.139
Growth Industrial Prod US (t-1)	-0.0295	0.0290	-0.0323
Constant	0.0303***	0.0364***	0.0275***
Observations	109	109	109

Notes: Robust standard errors. ***, ** and * denote significant at 1%, 5% and 10% respectively.

20. The size of the effect of changes in the interest rate environment on investment funds' flows is economically significant. We compute the standard deviations of the dependent variables (top of Table 4), and compare them with the predicted impact over one month of one standard deviation increase in each of the explanatory variables that are significant. We find that the impact of interest rates on net inflows (respectively redemptions) are particularly large as they explain 15–25 percent (respectively 60–70 percent) of the monthly standard deviations in the dependent variables. The impact of market returns and market volatility are also particularly large.

[5] In unreported regressions with subscription flows as the dependent variable we find smaller positive or non-significant effects of a decline in interest rates, confirming that the impact of a low interest rate environment is to a large extent driven by the response of redemptions which have declined significantly at an aggregate level as interest rates fell.

Table 4. Luxembourg: Quantification

	Bond UCITS	Equity UCITS	Corporate bond
One standard deviation of:			
Net inflows	1.40%	1.01%	1.25%
Redemptions	1.45%	1.05%	1.48%
Direct monthly impact of one standard deviation on:			
Net Inflows:			
EONIA	-0.2%	-0.3%	-0.3%
Euro STOXX growth	0.5%	0.5%	0.2%
Market volatility	N.S.	N.S.	N.S.
Redemptions:			
EONIA	0.8%	0.7%	0.9%
Euro STOXX growth	-0.3%	-0.2%	-0.2%
Market volatility	0.6%	0.2%	0.6%

21. These findings suggest that investors' aggregate portfolio allocation behaviors among investment funds, and between investment funds and other financial assets are very dependent on the monetary and financial market environments. The empirical analysis suggests that the decision to allocate savings between financial assets offering a safe nominal return (such as deposits) and more risky types of investments—such as equity and corporate bonds—are correlated among investors when it comes to the response to short-term interest rate movements or general market conditions. It is also noticeable that bond UCTIS can be impacted at the aggregate level, despite the fact that they include a significant share of government bonds.

22. Short-term interest rates and market conditions also impact redemptions from funds invested in government bonds. We also run the regressions of Tables 2 and 3 on a sample in which we remove corporate bond funds from the aggregate UCTIS bond fund category.[6] On net inflows we find that the effect becomes statistically insignificant. On redemptions, we find a positive significant impact of short-term interest rates, which is halved relative to the impact on the entire sample of UCTIS bond funds. Moreover, the effect of short-term interest rates becomes insignificant when we control for the market environment (which has a significant impact), suggesting that the shock to government bond funds is transmitted through the effect of interest rates on market performance and volatility. These findings are also consistent with the hypothesis that, while government bond funds may suffer from aggregate redemptions in the event of a negative shock, these redemptions could be somewhat compensated by gross inflows resulting from a portfolio rebalancing from riskier fund strategies.

[6] These regressions are available upon request.

Scenario Analysis

23. Scenario analysis shows that, while a smooth interest rate adjustment would be well absorbed by investment funds, a severe interest rate rise would have significant adverse effects on the fund industry:

- *The first scenario* considered encompasses a gradual return of EONIA to its 2015 average level over a period of one year. In this scenario, we estimate that the net outflows out of bond and equity funds would be in the range 1.4–1.8 percentage points while redemptions would be 3–4 percentage points.

- *The second scenario* illustrates a severe stress situation in which EONIA returns to its 2007 average level over a period of one year, meaning an interest rate rise of around 4 percent. In such a scenario of a very abrupt adjustment, the impact on the investment funds' industry would be severe: net outflows would be in the range 11.8–14.6 percentage points while aggregate redemptions would be 24.7–22.6 percentage points. This scenario considers only the direct impact of interest rates on investment funds' flows, holding market conditions constant. In the event of a large interest rate shock, financial market performance would fall and volatility would sharply increase. These market developments would in turn cause additional net outflows and redemptions, as well as negative valuation effects.

Table 5. Luxembourg: Interest Rate Scenario Analysis

Gradual Interest Rate Adjustment				Abrupt Interest Rate Adjustment			
***Direct* impact in percent of total net asset** Year-on-year percentage points change				***Direct* impact in percent of total net asset** Year-on-year percentage points change			
Impact on:	Bond UCITS	Equity UCITS	Corporate	Impact on:	Bond UCITS	Equity UCITS	Corporate
Net inflows	-1.4	-1.5	-1.8	Net inflows	-11.8	-12.6	-14.6
Redemptions	3.4	3.0	4.0	Redemptions	27.9	24.7	32.6

E. Conclusions

24. Accommodative monetary policy has benefitted Luxembourg's economy. Private consumption (and possibly investment) has risen, possibly as a result of wealth effects of higher house prices, and lower borrowing costs. However, intergenerational effects may be at play as younger households have faced growing affordability issues (see Chapter 2). The banking system appears to have passed on the monetary stimulus, while protecting its lending margins, and has become more interconnected in recent years, including with a strongly expanding investment fund industry, but also with cross-border "other financial institutions" operating treasury offices from Luxembourg. The investment fund industry has been a significant beneficiary of monetary policy, as a result of portfolio rebalancing effects, search for yield, and strong valuation effects in particular in stock markets.

25. Luxembourg faces risks related to the normalization of monetary policy going forward. Normalization of interest rates could trigger aggregate redemptions from the investment fund industry, in particular if the shock is very large and sudden. This could amplify existing liquidity mismatches between the underlying assets and redemption terms. Net asset value would also decline as a result of valuation effects. Banks could be impacted possibly through aggregate deposit outflows, and declining revenues. Net interest margins on fixed rate mortgages would also be compressed. Some households who borrowed at floating rates would also see their mortgage debt service increase.

26. To build resilience against such risks, the authorities should continue enhancing regulation and supervision in line with the 2017 FSAP recommendations, and in particular:

- *Better risk prevention and resilience* through strong risk monitoring and supervision of the banking system and its cross-border linkages, and of the investment fund industry, and by further developing internal capacity and methodologies for system-wide stress testing of investment funds, and provision of guidance to the industry on the design of liquidity stress tests;

- *Stronger macroprudential oversight* that will provide adequate macroprudential instruments such as borrower-based limits, and that will reinforce the willingness to act;

- *Better risk management* in particular through provision of guidance to the investment fund industry on liquidity management tools.

HOUSING MARKET: ASSESSMENT AND POLICY RECOMMENDATIONS[1]

Luxembourg's housing market has experienced continuously rising real estate prices which pose affordability problems and could lead to excessive indebtedness of some households as demand growth driven by demographic growth has outstripped new construction of dwellings. This affordability problem appears significant in a cross-country perspective. However, house prices remain broadly aligned with fundamentals, and the key issue to address is a lack of supply. Banks appear well capitalized and would be expected to withstand a partial equilibrium shock in the residential real estate market. However, household debt appears high, in particular among younger and middle-income households. Normalization of monetary policy could exacerbate the debt burden of some households and dent banks' margins. To increase the housing supply, policies should reduce rigidities in land availability for construction, zoning restrictions, and increase means-testing for the various tax expenditures and subsidies that support demand.

A. Introduction

1. This chapter assesses the Luxembourg housing market from the point of view of affordability and suggests policy responses.[2] The residential real estate market has experienced a growing affordability problem arising from a lack of supply in the context of a fast-growing economy and net demographic growth. High house prices also create financial stability risks, via the balance sheets of households or of banks if Luxembourg were to be affected by a severe negative shock.

2. The chapter is organized as follows. First, it provides a comparative stylized analysis of the housing market in Luxembourg and points at supply constraints; second, it presents the assessment of residential real estate (RRE) prices and concludes that they do not appear to deviate from fundamentals; third, it provides an analysis of financial stability risks; fourth, it elaborates on specificities in the Luxembourg housing market. The last section concludes.

B. Stylized Facts

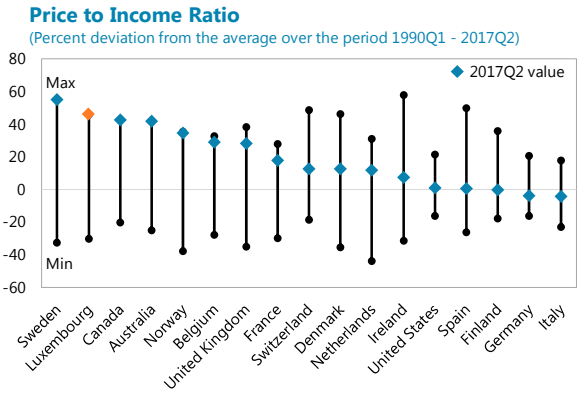
3. In recent years, a significant affordability problem has become increasingly visible in the Luxembourg RRE market. In 2017:Q2, the price-to-income ratio stood at 45 percent above its 1990–2017 average, the second highest deviation from historical average among a group of OECD countries. Since the global financial crisis, Luxembourg's rapid RRE price growth has ranked the 9th highest among 25 OECD countries. The affordability problem is illustrated by the striking divergence between income per capita and house prices since the early 2000s: while GNP/capita is only 1.1 percent higher than in 2002, house prices are on average 85 percent higher. This divergence is the consequence of both net demographic growth and a growing share of GDP accruing to

[1] Prepared by Michelle Hassine and Thierry Tressel (EUR).
[2] This paper builds on the analysis presented in "Luxembourg: Financial Sector Assessment Program: Technical Note – Macroprudential Framework and Policies", published August 28, 2017, International Monetary Fund.

cross-border commuters, in the context of a sustained growth of demand for labor. The rental market has not kept up with the increase in housing prices: in 2017:Q2, the price-to-rent ratio stood very significantly above its historical average, by some 45 percent. The cash flows on housing investments have declined, suggesting that such investments have become more and more driven by expected capital gains.[3]

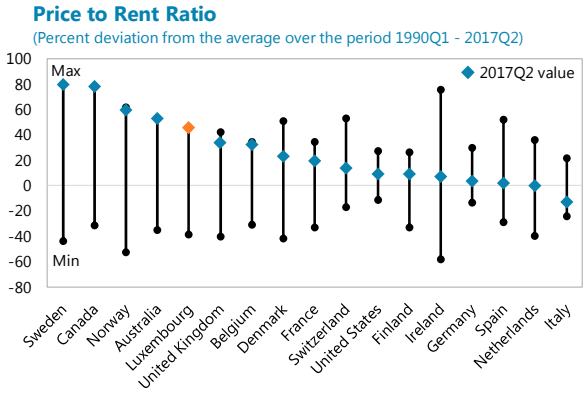
Figure 1. Stylized Facts on Residential Real Estate Prices

Price-to-income ratio is at historically high levels ...



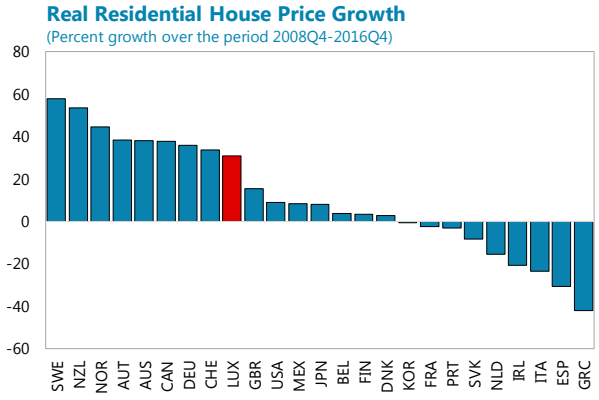
Sources: OECD and Banque Centrale du Luxembourg.

... and so is the price-to-rent ratio.



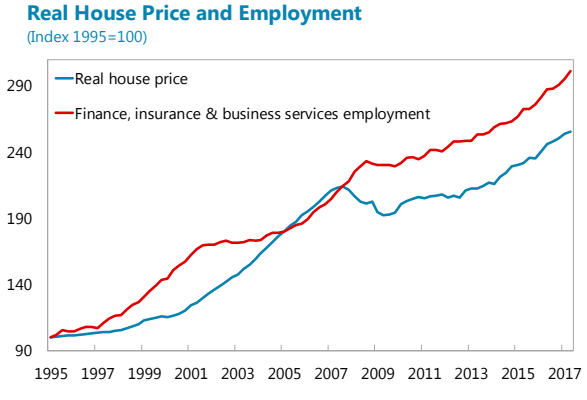
Sources: OECD and Banque centrale du Luxembourg.

House prices have grown fast since the global financial crisis ...



Source: IMF Global Housing Watch.

... and in line with growing employment.



Sources: BCL and STATEC.

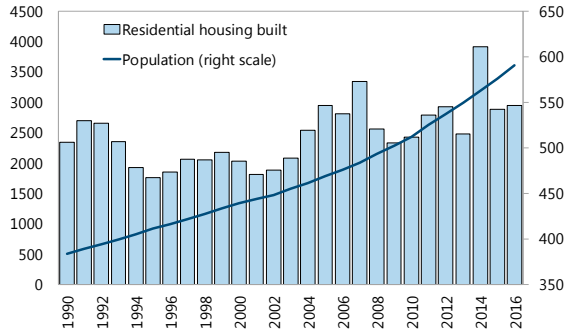
4. The supply of dwellings has not kept up with a rapidly growing demand. Since 1990, resident population has increased by about 50 percent—or 200,000 inhabitants. In addition, 45 percent of the labor force (about 180,000 workers) are cross-border commuters. This creates a large latent demand which contributes to sustaining high residential real estate prices. Transactions have risen steadily since the global financial crisis, pushing up prices both for houses and apartments.

[3] Rental income is capped at 5 percent of the purchase value of the dwelling but tax deductions stimulate the return on investment during the first five years after purchase. Rents can also be revalued when tenants change.

Figure 2. Demand Pressures and Transactions

Supply has not kept up with demand …

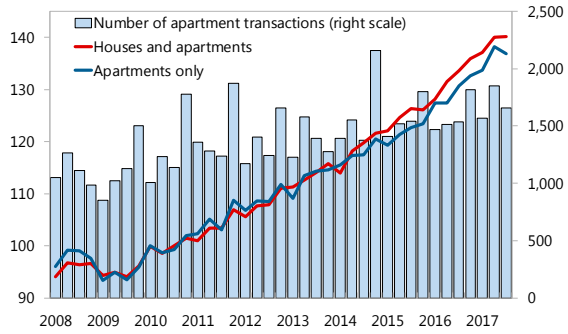
Construction Activity and Population Pressures
(Thousands of square meters; right scale in thousands of persons)



Source: STATEC.

… and transactions have risen for houses and apartments

National Housing Prices and Transactions
(Index number, Q1 2010=100; Right scale in units)



Sources: STATEC and IMF Staff calculations.

C. Are Residential Real Estate Prices Aligned with Fundamentals?

5. We develop a dynamic empirical model of RRE prices that aims at capturing Luxembourg specificities (Box I). We perform a time series regression analysis of the dynamics of RRE prices over the period 1985:Q1-2016:Q1. We explain the growth rate of house prices by structural considerations, which include: (i) a measure of housing investment (the volume of housing in approved construction permits); (ii) a measure of structural demand related to the dynamics of population (net migration flows); and (iii) a measure of affordability (the price-to-income ratio). We also include as explanatory variables indicators of a more cyclical nature such as: (i) the growth rate of construction costs; (ii) real mortgage interest rates; (iii) mortgage credit growth, and (iv) the growth rate of residential permits (which captures the impact of non-linearities in the rate of new residential construction).

6. We find that structural supply and demand considerations as well as more cyclical factors help explain the dynamics of RRE prices. RRE prices respond positively to demand pressures related to demographic growth, and negatively to increases in the supply of dwellings. While the variable capturing affordability also plays a role in explaining RRE prices in a bivariate model, its sign becomes statistically insignificant once the two supply and demand variables are included in the regression. RRE prices are also influenced positively from the supply side by the costs of construction as expected, and negatively by mortgage interest rates which have a small cyclical effect on demand. Last, an increase in dwelling construction permits has a smaller negative impact on house prices when the flow of permits is already high (as shown by the positive coefficient on the growth rate of construction permits).

Determinants of Real House Price Growth (YoY)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Structural factors							
Log(price to income ratio) (t-4)	-0.0517*	0.00113	0.0372	0.00429	-0.00813	-0.0603	-0.0617
Log (Residential permits) (t-4)		-0.126**	-0.178***	-0.117**	-0.157***	-0.0834*	-0.0788*
Log (Net migration) (t-4)		0.0238	0.0412***	0.0295**	0.0358***	0.0207*	0.0214*
Cyclical factors							
YoY growth construction costs (t-1)			1.313***	0.846**	1.583***	1.188**	1.226***
YoY growth residential permits (t-1)				0.153***		0.163***	0.143***
Real mortgage rates (t-1)					-0.506	-0.702	-0.746*
YoY mortgage credit growth (t-1) [1/]							0.158
constant	0.0605***	0.673**	0.837***	0.549**	0.762***	0.426*	0.387
Nb. Obs	124	124	124	123	124	123	123

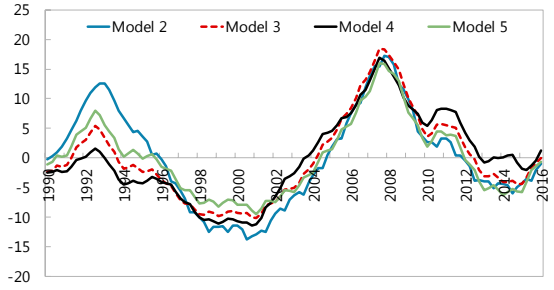
*Note: Newey West estimator with 4 lags autocorrelated residuals, *** p<0.01, ** p<0.05, * p<0.1*
Sample period: 1985:Q3-2016:Q1.
[1/] Deflated by CPI.

7. A simple quantification shows that the economic effects of structural and cyclical supply and demand considerations are significant. Based on the regression reported in the Table above, column (5), we find that, considering structural factors, a one standard deviation shock to residential permits (respectively net demographic growth) is associated with a 4.3 percentage point decline (respectively 3.2 percentage point increase) in real house price growth. These are large effects considering that the standard deviation of RRE price growth is 4.9 percentage points in our sample. Cyclical factors such as construction costs and real interest rates also have economically meaningful effects on house prices: one standard deviation increase in these two variables are associated respectively with a 3 percentage points increase and 1.5 percentage point decrease in RRE price growth, though the effect of interest rates is not always significant.

Quantification	
Standard deviation of real house price growth	4.9%
Impact of a one SD shock to:	
Residential permits	-4.3%
Net migration	3.2%
Growth of construction costs	3.0%
Real interest rate	-1.5%

8. Our model suggests that real house prices are broadly in line with fundamentals. The predicted real house price index is computed as the index of house prices predicted by the regression coefficients under the assumption that the predicted index takes the same value as the historical average of the actual index during 1985–2016. At any point in time, the percent deviation between the actual house price index and the predicted house price index measures the overvaluation (if the deviation is positive) or the undervaluation (if the deviation is negative). We compute this deviation for the regression models 2–5 reported in the above table. We find evidence that real house prices were quite significantly overvalued (by about 15 percent) in the years leading to the global financial crisis and that since then prices have gradually converged to their expected levels consistent with fundamentals.

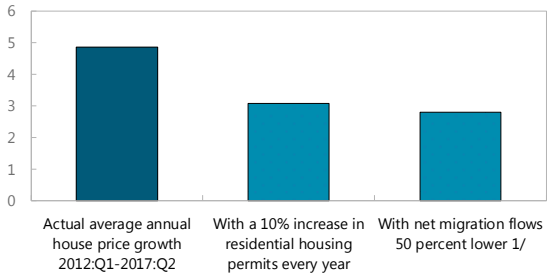
Real House Price Valuation
(Percent deviation of actual prices from equilibrium levels)



Note: deviation normalized by assuming no misalignment on average over 1990-2016.
Source: IMF Staff calculations.

9. Illustrative scenario analysis suggests that changes in the supply of dwellings or in population flows would significantly affect the dynamics of RRE prices. We consider two scenarios: (i) an increase in the volume of approved residential construction permits of 10 percent relative to the 2012–16 average; and (ii) a 50 percent decline in average net migration flows relative to the 2012–16 average.[4] In the first scenario, annual house prices would have grown at a rate about 1.8 percentage points lower relative to the 2012–16 average of close to 5 percent. In the second scenario, a return of net population flows to their 2002–06 average would result in a decline of annual house price growth by about 2 percentage points.

Illustrative Impact of Housing Supply and Net Migration on Annual Real House Price Growth
(Percent)



1/ Net migration at about 2002-2006 levels
Source: IMF staff calculations.

[4] This broadly corresponds to a decline in average net migration back to the 2002–06 average.

Box 1. A Model of Residential Real Estate Prices for Luxembourg

We estimate an empirical model linking house price growth to a set of structural and cyclical fundamentals estimated at a quarterly frequency over the period 1985:Q1–2016:Q1:

$$\Delta RRE_t = \varphi + \sum_k \beta_k \cdot \Delta X_{kt-1} + \sum_v \gamma_v \cdot Y_{vt-l} + \varepsilon_t \qquad (1)$$

Where ΔRRE_t is the year-on-year growth rate of the real house price index, ΔX_{kt-1} is a vector of cyclical variables, Y_{vt-l} is a vector of structural variables (lagged l times), ε_t is a residual with an autocorrelated lag structure with up to 4 lags. Cyclical determinants of real house prices include the growth rate of construction costs, the average real interest rate on [new] mortgages, and, in some specifications, the lagged growth rate of construction permits (which could for instance capture the speed at which administrative constraints are addressed) and the growth rate of mortgage credit. Structural factors include the log of the price-to-income ratio (a measure of affordability), lagged one year, a proxy for the growth of the supply of dwellings and a proxy for demographic determinants of housing demand. The proxy of residential investment is the log of residential permits issued, lagged one year, and the proxy for demographic factors is the log of net migration. The empirical model also includes a dummy variable equal to one in 1998/1999 to capture any potential breaks related the introduction of the euro.

The underlying "long-term" model of real house prices RRE_t is given by a relationship between real house prices, the stock of dwellings K_t, the stock of population POP_t and an affordability indicator AFF_t:

$$RRE_t = \alpha + \beta \cdot K_t + \gamma \cdot POP_t + \delta \cdot AFF_t + \mu_t \qquad (2)$$

Expressed in log first difference and using building permits and net migration as proxy respectively for the net capital stock and population change, we obtain the following relation:

$$\Delta RRE_t \approx \alpha + \beta \cdot \Delta K_t + \gamma \cdot \Delta POP_t + \delta \cdot AFF_t + \mu_t \quad (3)$$

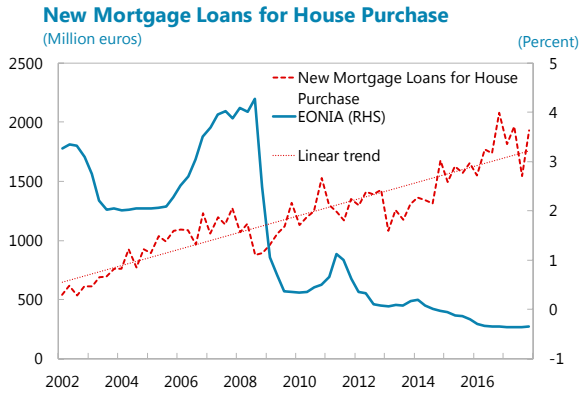
The model builds on an earlier model developed in the 2017 Luxembourg FSAP Technical Note "Macroprudential Framework and Policies" by adding structural indicators of the stock of housing and of demand for housing, which, with the exception of affordability indicators, were often not included in the earlier literature (see for instance Loungani and Igan (2012)). Adding such indicators appears quite relevant in the case of Luxembourg where the stock of dwellings is relatively new and expanding, and where net migration has been very significant in recent decades. Several recent cross-country papers such as Caldera Sanchez and Johansson (2011) and Arestis and Gonzalez (2013) also consider similar supply and demand considerations and assess the relationship between housing investment and price responses among OECD countries. In the case of Luxembourg, and closest to our approach, Filipe (2017) develops a vector error correction model with co-integration equations between house prices, mortgage credit, building permits, construction costs, mortgage rates and real GDP per capita. In contrast to her paper, in our model migration flows and building permits are associated with the *growth rate* of house prices instead of their level.

D. Financial Stability Considerations

10. Mortgage credit has grown steadily in the past decade. Despite some volatility of new mortgage production, there is no evidence of an acceleration in the production of new mortgages which seems to have grown at a broadly steady rate since the early 2000s. The growth of mortgage credit seems to have been driven by lending from the domestically oriented banks to resident households, but other banks serving an international clientele have also increased their supply of mortgages for non-resident borrowers, often as part of packages of services related to private banking and wealth management activities.

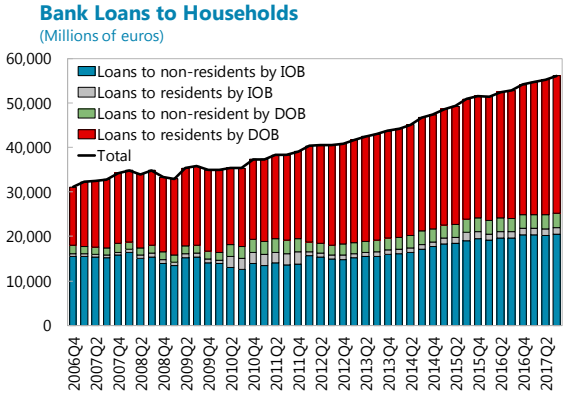
Figure 3. Mortgage Credit in Luxembourg

New production of mortgage loans has grown steadily despite its volatility.



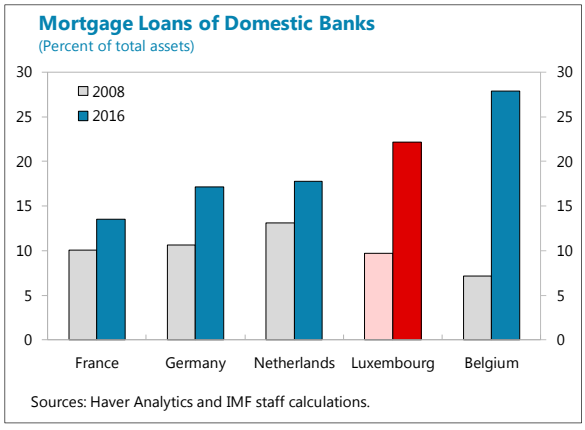
Source: Banque Centrale du Luxembourg.

Credit growth has been mostly driven by the domestic market but lending to non-residents has also grown.



Source: BCL.

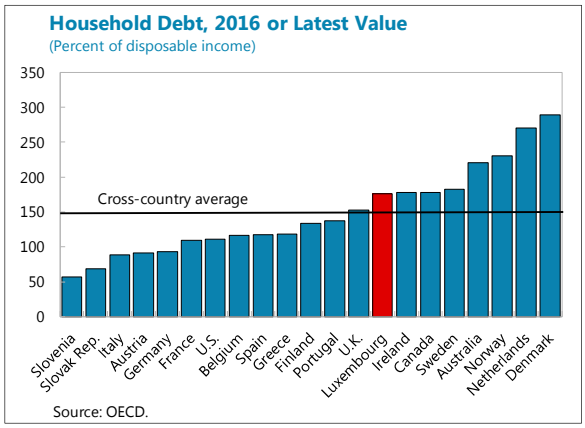
11. The authorities have taken measures to strengthen the resilience of banks to potential shocks from their RRE exposures. Exposures of domestically oriented banks to residential real estate has risen very significantly since the global financial crisis. Since 2012, the *Commission de Surveillance du Secteur Financier* (CSSF) has put in place the following measures: adjusted risk-weights of 75 percent under the standardized approach for the part of new mortgage loans that exceeds a loan-to-value (LTV) ratio of 80 percent instead of the standard 35 percent risk-weight; stricter stress test requirements for IRB banks' mortgage books, and Pillar II capital add-ons for banks with main exposures to real estate due to "concentration risk." In addition, three credit institutions, operating in the residential real estate sector and maintaining major mortgage books, have been identified as systemically important with the application of additional capital requirements of 0.5 percent of RWAs. On August 31, 2016, and



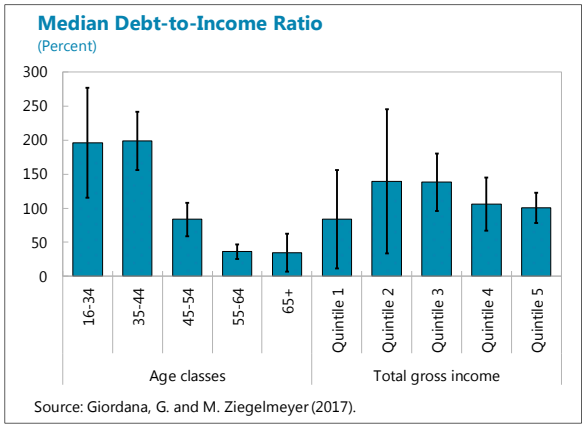
Sources: Haver Analytics and IMF staff calculations.

following a recommendation of the Systemic Risk Committee (CdRS), IRB banks have been required to apply a risk weight floor of 15 percent for exposures to Luxembourg residential real estate.[5]

12. Household debt has on average reached high levels in relation to disposable income, but financial assets are also high. At an aggregate level, household debt reached 175 percent of disposable income in 2016 placing Luxembourg above the average of about 150 percent among a group of OECD countries. However, at an aggregate level, this debt appears to be well covered by the liquid financial assets of households: according to the sectoral financial accounts of Luxembourg, total savings and deposit accounts of households reached €41.5 billion in 2017:Q3 compared with an aggregate stock of debt of €36.9 billion.[6] Moreover, ability to repay appears good for the median household, at least until 2014: according to the 2014 Luxembourg Household Finance and Consumption Survey, the median debt service-to-income ratio stood at 14.8 percent and the median LTV ratio stood at 34.6 percent.



13. However, medium-term vulnerabilities resulting from high indebtedness appear very clearly among younger household cohorts, and the share of high LTV mortgage loans has risen. According to the 2014 Luxembourg Household Finance and Consumption Survey, younger household cohorts (of age below 45) had very high debt-to-income ratios with *a median* approaching 200 percent.[7] If households are classified by income, indebtedness appears to be larger among middle income households, while lower income and to some extent higher income households seem less indebted. The normalization of monetary policy in coming years would expose some households to interest rate risks and increase their debt burden, as about 50 percent of mortgages remain at adjustable rates.



[5] Since 2014, all credit institutions in Luxembourg are subject to a (fully-loaded) capital conservation buffer of 2.5 percent.

[6] BCL statistical table 05.08. The aggregate figures reported are an approximation based on the financial assets and liabilities of the aggregate accounts of households and non-profit organizations serving households.

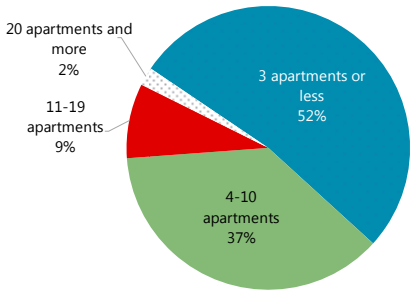
[7] Giordana, G. and M. Ziegelmeyer (2017), "Household debt burden and financial vulnerability in Luxembourg" *Banque Centrale du Luxembourg* Working Paper 113. However, low interest rates may have helped contain debt service.

14. In addition, in recent years the share of potentially risky mortgages has become large in the new production. While the average LTV ratio on the stock of existing mortgages is below 50 percent, about 25 percent of mortgages have a LTV ratio equal to or above 80 percent, suggesting that some pockets of the market could be sensitive to price declines coupled with interest rate increases. In recent years, about 40 percent of new residential mortgage loans had an LTV ratio about 80 percent, well above the 25 percent of such loans among the outstanding stock of mortgages. Thus, in the past decade banks have increasingly offered loans that are less covered by the value of the property. Moreover, the growing share of fixed rate mortgages in the new loan production relative to historical practices has exposed banks to some compression of margins that would materialize when monetary policy normalizes. However, annual partial equilibrium stress tests by the CSSF suggests that banks thus far have generally solid buffers and could absorb a shock that would arise in the real estate sector.

E. Special Features of the Luxembourg Real Estate Market

15. The structure of real estate development highlights a preference for low-density housing. The residential real estate stock mainly consists of single-family houses and small-size apartment buildings. As of March 2017, half of the 233.7 thousand dwelling inventory consists of single-family houses and only 35 percent of the dwellings are multi-family buildings. Apartment buildings rarely encompass more than 10 apartments—more than half of multi-family units have three apartments or less.

Apartment buildings by size, 2016



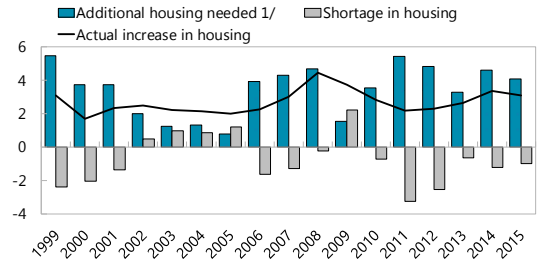
Source: STATEC, July 2017.

16. The gap in the supply of dwellings resulting from demand pressures is estimated to be significant and will continue to grow into the medium-term under current policies. The number of new dwellings completed averaged about 2,700 new units every year since 2000. Given the growth in resident population, this suggest an average gap of about 3,000–3,500 new dwellings per year—amounting to a cumulated gap in new housing estimated in the range of 54,000–63,000 since 2000. Projections by STATEC completed in 2010 found that about 6,500 dwellings are annually needed by 2030 to absorb population growth, given the demographic assumptions based on 2005–10 trends.[8] Moreover, the large contingent of daily commuters from neighboring countries creates an additional potentially large latent demand.

[8] http://m.statistiques.public.lu/fr/methodologie/methodes/population-emploi/Pop-logement/projections-menages-logements/Projections-des-menages-prives-et-des-besoins-en-logement.ppt

17. Land available for new construction is sparse. Total land opened for new construction in Luxembourg is estimated at about 2,700 hectares (about 10.4 square miles or 1 percent of Luxembourg's total territory). However, new construction since 2000 concentrated on a few areas—a quarter of all new housing was built in or in the immediate vicinity of Luxembourg-City. In those areas, land available for housing construction is now scarce, with vacancy rates for housing construction at a low 10–15 percent range.[9] Outside these high-demand areas, vacant land is relatively abundant. Three-quarter of municipalities in Luxembourg used their available land sparingly, dedicating in average 2.5 hectares for new housing construction, and still have a large contingent of available land. This reflects tight distributional issues in land allocation, and municipalities' diverse responses to higher demand for new housing.

Luxembourg: New Dwellings and Population Growth — Estimating The Housing Gap
(In thousand units)



1/ Based on the assumption that the rate of occupancy per dwelling stays constant at its level of end-March 2017.
Sources: STATEC data and IMF staff estimates.

18. Zoning is complex and fragmented, and municipalities have latitude to decide on new construction. The Luxembourg territory is divided in 102 municipalities, which have to establish a land-use plan (plan d'aménagement general, PAG) and so define the building perimeter of land for constructed areas. This land-use plan must be elaborated in respect of the Master Program for Spatial Planning (*Programme Directeur d'Aménagement du Territoire,* PDAT), and the sectoral plans. The PDAT encapsulates the government's long-term general objectives and priorities. These are detailed and executed through sectoral plans. One sectoral plan will be dedicated to housing issues. However, sectoral plans only set general guidelines and broad principles, leaving wide scope for interpretation and implementation. Moreover, inter-municipal multi-level cooperation to foster regional growth does not create binding rules and government authorities cannot compel municipalities into action.[10]

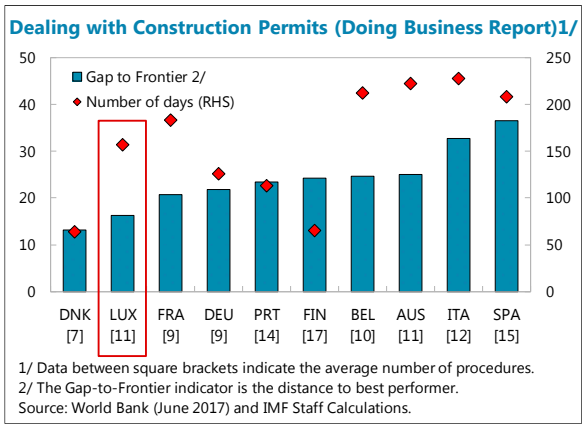
19. Construction relies on complex norms and requirements that tend to increase building costs. Construction norms are bound by municipality rules: The municipal land-use plan (PAG) identifies areas reserved for low density or high density housing, mixed areas (open to housing and/or complementary functions such as commercial, administrative, or trade), public facilities, areas for economic activity, and areas that are to remain free, dedicated for agricultural, recreational use and nature. Furthermore, the build-up areas are stated precisely with some density factors such as housing density, or norms for parking lots for example. The detailed urban development plan (*plan d'aménagement particulier,* PAP) specifies the land-use plan by precise urban development requirements such as the layout of the residential allotments, building heights or the

[9] For example, the percent of lots available for housing construction are 19 percent in Luxembourg-Ville, 9 percent in Esch-Sur-Alzette, 10 percent in Ettelbruck, 12 percent in Junglinster, 13 percent in Diekrich, and 15 percent in Mersch.

[10] Municipalities predate the formation of the Luxembourg state in 1839 and have communal autonomy, which is enshrined in the Constitution. Municipalities have executive municipal councils (*Schöffenräte*) with large powers for local infrastructure and land use, including housing.

implementation of the buildings. The cost of new housing developments has been increasing under cumulative requirements for the use of space and energy-efficiency. For example, each new dwelling must be supplied with one to two created parking spaces on private land—which often requires expensive digging for underground parking. Nevertheless, land-use and urban development regulations were reordered in 2011 to simplify urban planning and their adoption procedures were shortened in March 2017. The results of this administrative facilitation become only visible when the municipalities have reviewed their land-use plans (deadline August 2018).

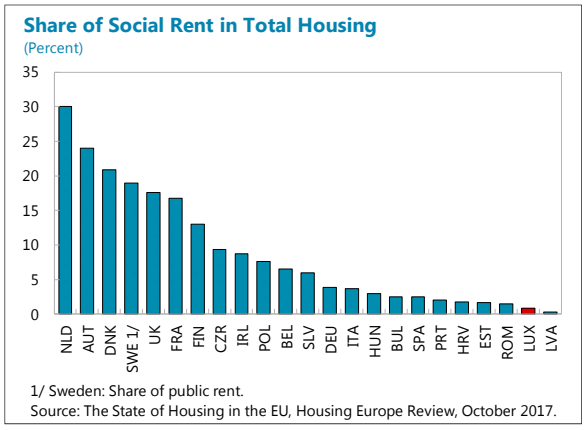
20. Most of the available land is in the hands of private owners and difficult to mobilize. 92 percent of the 2,700 hectares available for construction belong to private owners; public developers can mobilize only 0.7 percent of it. While municipalities are allowed to discourage land hoarding by levying a tax surcharge on unused land, only a few municipalities have done this so far, suggesting insufficient tools to effectively mobilize new land for housing development. Conscious of the difficulties in mobilizing construction land the Ministry of Interior launched the so-called site development contract "Baulandvertrag" in a draft law. This contract is concluded between the owner of the land and the municipality. The objective is to guarantee a rapid development of the construction site after the land was converted from "reserve development land" into "active development land or building ground." If the owner does not realize the servicing infrastructure in a time-lapse of 3 years, either the land will be returned to "reserve land" or the municipality could purchase the active development land.



1/ Data between square brackets indicate the average number of procedures.
2/ The Gap-to-Frontier indicator is the distance to best performer.
Source: World Bank (June 2017) and IMF Staff Calculations.

21. The process of obtaining building permit is not sufficiently fluid, although recent legislation would help streamline the process. Luxembourg ranks seventh worldwide for the ease in obtaining a construction permit. However, the number of procedures is comparatively high and requires on average 157 days to complete, reflecting complexity in obtaining the various required authorizations.

22. The share of social housing is very low compared to other European countries. Affordable housing is scarce, not least because of insufficient new supply in rental social housing, whose inventory is below 1 percent of total housing.



1/ Sweden: Share of public rent.
Source: The State of Housing in the EU, Housing Europe Review, October 2017.

23. Public developers have a mixed mandate—supply both affordable real estate and low-cost rental social housing. Social housing is managed through waiting lists,

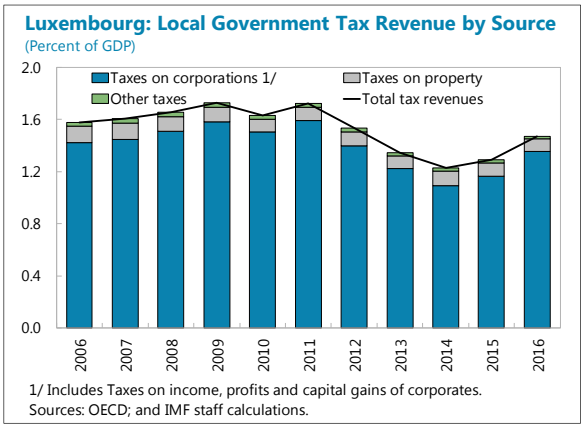
attributed in the context of poverty reduction measures, and supplied mainly through three public developers. The largest one, the *Fonds du Logement* constructs, renovates, and manages about 2,000 dwellings. The *Société Nationale des Habitations à Bon Marché* (National Affordable Housing Company), formed as a joint stock company, has a broad mandate comprising new housing, new regional development plans, and completing public infrastructure. Its main activity is to provide real estate for sale below market prices to low-income qualifying households, but it also has a small inventory of rental dwellings. Municipalities—the third largest group of developers for social housing—may elect to provide social rentals, but tend to prefer increasing the share of owner-occupied housing and are reluctant to devote costly technical and administrative resources to manage social rental housing. The private supply of subsidized housing was sparse, as the requirement to develop 10 percent of the projected dwellings in any urban development plan with a surface of more than 1hectare was not effective enough. Therefore, this action has been reinforced in March of 2017 as 10 percent of the total square meters build in each urban development plan, counting more than 25 dwellings, must be affected by subsidized housing and the municipalities could even determine the price of these units. The effect of this recent adaptation is not visible for the moment.

Table 1. Luxembourg: Rental Social Housing in Luxembourg—New Construction by Public Developers, 2015–18

	Inventory at end-2015	New housing added in 2016	New housing added in 2017	New housing to be added in 2018	Expected inventory in 2018	Change in inventory 2015-18
Fonds du Logement	1,737	20	133	180	2,070	333
SNBHM	184	69	42	208	503	319

Sources: Ministry of Housing (Ministère du Logement); Annual Report SNHBM; and IMF staff calculations.

24. Innovative ownership forms have started to ease new supply and help improve affordability. The Ministry of Housing identified that about a third of the available land for housing (an aggregate 1,000 hectares or about 3.8 square miles) can be mobilized through emphyteutic leases (*Baulückenprogramm)*.[11] However, new housing supply associated with these regulations has so far been limited. Municipalities' tax resources primarily stem from corporations



[11] *Baulücken* were created in 2008 and are established on land belonging to municipalities which is constructible but not yet used. Under emphyteutic leases, municipalities retain the ownership of the land, while homeowners receive the right to use the land against an annual lease over 27 to 99 years and can sell it back.

operating on their territory, thereby creating a preference for commercial real estate at the local level. Businesses provide the lion's share of local governments' tax revenue (about 92 percent in 2016). The main tax is the local municipal tax on trade (rate at an average 7.5 percent on net profits), and the property tax (*Impôt foncier)*.

25. There has been demand to expand commercial real estate. The development of commercial real estate tends to yield more tax income for municipalities than residential real estate. It also tends to bear less stringent administrative and infrastructure constraints than housing. To promote Luxembourg as a commercial center in the *Greater Region*, the moratorium on large-scale retail areas was lifted in 2005, thereby creating large mall areas and shopping outlets.[12] By 2010, more than 2,000 square hectares of large-scale retail areas had been approved. Moreover, municipalities are entitled to steer zoning rules on lots meant for mixed purposes (commercial and residential) mainly towards commercial development.[13] Anecdotal evidence indicates that in certain cases dwellings in Luxembourg-City were converted to office space, given tight vacancy rates in commercial real estate.

26. In very rare cases, the reform of municipality funding at end-2016 could tend to reduce the bias in favor of commercial real estate. One of the main tax resource of municipalities is the *Impôt commercial Communal,* (municipal tax on trade, ICC) a local corporate income tax levied on businesses, which supplies a quarter of Luxembourg CIT revenue. The December 2016 reform of local finances mandates that municipalities keep a maximum of 35 percent of their ICC revenue, with the remainder redistributed among municipalities.[14]

27. Various tax mechanisms which are mostly not means-tested tend to stimulate demand for home-ownership. (Table 2) Home ownership in Luxembourg creates a strong tax shield and has benefited from direct subsidies, proportional to the taxable income and house value. Various fiscal support mechanisms are available to reduce closing costs for owner-occupied home purchases and interest payments are partly tax deductible. In the case of sale of real estate used as primary residence, the capital gain is not taxable, and there are reduced taxes on capital gains for other real estate. [15]

[12] The Greater Region has 11.2 million people and covers 25.2 thousand square miles and includes, besides the Grand Duchy of Luxembourg, Wallonia and the German-speaking community in Belgium, Saarland and Rhineland-Palatinate in Germany, and Lorraine in France.

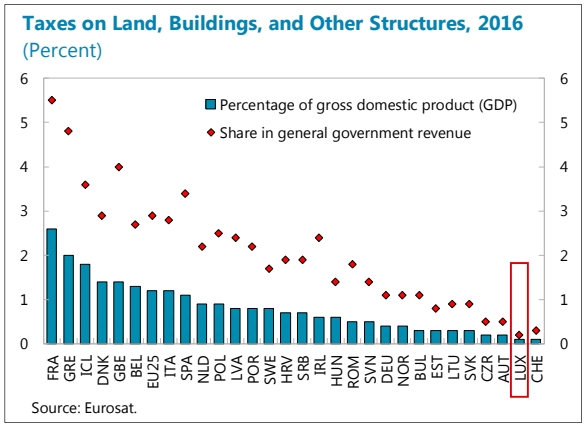
[13] See Affolderbach and Carr (2014), Blending Scales Of Governance: Land Use Policies And Practices In The Small State Of Luxembourg, https://orbilu.uni.lu/bitstream/10993/15357/1/Affolderbach_Carr_author%20pre-print_Regional%20Studies_2014.pdf

[14] The distribution of the General Fund of Municipalities to municipalities observe the following key after distribution of a lump-sum to municipalities: adjusted population (82 percent), social demography (9–10 percent), adjusted territorial size (5 percent), number of wage-earners (3 percent), and number of social housing (1 percent). The Law is available from http://legilux.public.lu/eli/etat/leg/loi/2016/12/14/n1/jo.

[15] The normal rate is half of the marginal personal income tax rate applicable; the reduced rate is a quarter of the relevant rate until end-2018. At the top marginal rate of 42 percent, the taxation rate on capital gains for real estate is 10.5 percent.

28. Tax deductibility of mortgage debt payments is encouraging higher household leverage. The tax treatment of mortgage loans may encourage high household debt, as demonstrated by recent literature.[16] Mortgage interest payments on the primary residence are partly tax deductible. Thus, it may provide a powerful incentive to use housing investment as a tool to buildup household assets through leverage. In comparison with European peers, where mortgage interest deductibility was reduced over the past decade, the Luxembourgish regime maintains a generous incentive.

29. Low property taxes associated with cadastral bases unrevised in the past 70 years point to the misallocation of land resources. Property taxes in Luxembourg are among the lowest in Europe. This tends to favor investment in housing over financial assets. In a context of rising land prices and scarce constructible land, a low tax rate on real estate may encourage owners to hold on to their land. Hence, sparse revision in tax bases combined with low rates may reduce the elasticity of housing supply to price developments. The temporary reduction in the tax on capital gains for real estate sales by end-2018 may nevertheless encourage sales in constructible land.



F. Conclusions and Policy Recommendations

30. Demand for housing has exceeded supply for many years. While house prices are in line with fundamentals, they have risen faster than disposable income for years, largely because of structural supply constraints in the context of strong demand, in part reflecting net demographic growth. The dynamics of house prices is also somewhat affected by cyclical factors such as the cost of construction and to some extent the low interest rate environment. Rigid zoning and administrative rules together with land hoarding prevent sufficient construction, while tax incentives and subsidies fuel demand. Reduced affordability has driven up household indebtedness, in particular among younger households.

31. Risks in the real estate market should continue to be closely monitored, and further actions taken as needed. Recent measures have appropriately built capital buffers in the banking system while discouraging riskier lending. However, household debt is relatively high and limits to debt-service-to-income ratios should be set if house prices continue to outpace disposable incomes. Going forward, the normalization of interest rates could add to the debt service of some households (who borrowed at variable rates) while banks' margins on their stock of fixed rate mortgages would shrink.

[16] The seminal work of Poterba and Sinai (2008) highlights that household balance sheets are sensitive to the treatment of mortgage debt.

32. Containing house price pressures and alleviating bottlenecks of housing require a strong effort to expand the stock of housing:

- Excessive red tape in bringing additional land to construction should be pruned, and incentives strengthened. The initiatives of *Baulücken* for new construction are a step in the right direction;
- Local zoning decisions should be better coordinated with a national spatial development plan and cooperation among municipalities should be encouraged;
- Existing tools to mobilize vacant land and unoccupied dwellings could be strengthened. This includes implementing taxation on vacant lots. In this respect, the initiative of *Baulandvertrag* goes in the right direction; [17]
- In the PDAT and the municipal implementation, assigning "mixed construction" land in priority to residential real estate would widen the share of land eligible for housing development;
- Tax biases at the municipality level against residential real estate should be reduced further. The reform of the distribution of municipal business taxes among municipalities is a step in the right direction as it reduces incentives favoring commercial over residential real estate zoning decisions. Going forward, policies should increase the share of the ICC redistributed in the equalization fund;
- Increasing property taxes and revising cadastral values would help municipalities increase own resources.

33. The share of social and affordable housing in total housing could be increased:

- To encourage social housing in the rental segment, public developers in the social sector (FSH, SNCHM, and municipalities) should be gradually steered only towards the development and management of social rentals. This would help clarify management roles and separate more clearly the rental activity from the construction-for-sale business.

34. Tax expenditures and subsidies should become more means-tested to help address affordability issues for young and lower-income households, and first-time homebuyers. Tightening eligibility for real-estate related tax incentives and subsidies would also help alleviate some of the demand pressures on prices.

[17] The *Loi Omnibus* in February 2017 created the *Baulandvertrag* contracts, which introduce a mandate for construction on certain vacant lots with a sanction on owners through a binding sale to municipalities.

Table 2. Luxembourg: Taxation Measures Supporting Residential Real Estate Investment

Base	Detail	Means tested with exclusions? (Y / N)	Conditions
Capital grants	On purchase and construction	Y	Means tested and based on income/family situation/construction type.
	Renovation of main residence	N	30% of cost, capped at 10,000€/ beneficiary
	Klimabank: Energy-efficient renovation and construction	Y	Protecting impoverished families against high heating costs
Other measures reducing downpayment	Reduced VAT on purchase of new construction and eligible renovation	N	3% VAT instead of 17% cap: 50,000€/dwelling
	Reduced notarial fees (7% dues) for the sale of the main residence.	N	Notarial fees are reduced by 20,000€/person, taking the form of a tax credit applicable to subsequent purchases, until they are exhausted.
	Home saving scheme	N	When dwelling is purchased with a scheme, tax deductibility set at 1,344€ when below 40 years old, and 672€ otherwise.
Reduced tax on capital gains	Sale of RE (not necessarily own residence)	N	Temporary reduction to 25% of taxpayer's applicable marginal tax rate; Ending at end-December 2018.
Lowering effective mortgage rate	Interest reduction -- from 0.575 to 2.45 percent	N	Amount based on taxable income and family status. It can be cumulated with other fiscal provisions.
	Interest reduction for families -- 0.5% per child	N	Capped under a 3 percent ceiling per family. It can be cumulated with other fiscal provisions.
	Mortgage interest deductibility	N	On owner-occupier, per person in the household (revised from 01.01.2017): Years 1-6: 2,000€/y Years 7-10: 1,500€/y from year 11: 1,000€/y
	Renting out a dwelling classified as social housing	N	50% exemption from income tax.
Lowering cost of mortgage	Lower mortgage insurance through state guarantee	Y	For HH whose collateral is insufficient
Increasing disposable income, eligible for mortgage payment	Rental income on own-occupied home: abolished	N	Helps increase income, eligible for assessing PTI ratio

Sources: Observatoire de l'Habitat (2018)

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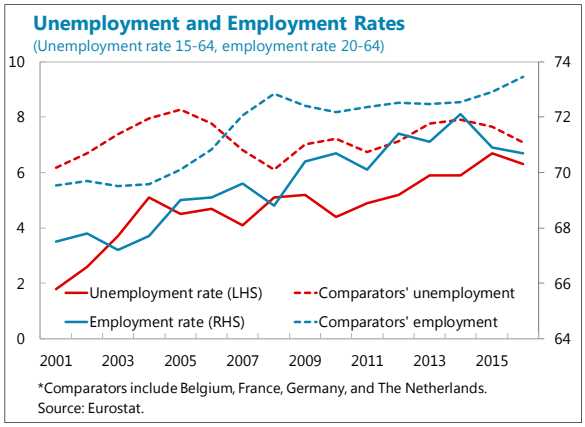
WORK-WELFARE TRADE-OFFS AND STRUCTURAL UNEMPLOYMENT IN LUXEMBOURG[1]

Job creation is strong in Luxembourg, but unemployment is declining gradually and many newly created jobs go to cross-border workers. The employment rate of residents is relatively low, especially for low-skilled, young, and older workers. Moreover, female attachment to the labor market is weak, and the share of the long-term unemployed has increased over the last ten years, but seems to have come down somewhat in recent months. In addition to skills mismatches, work disincentives inherent to the tax-benefits system are a factor in explaining structural unemployment.

This chapter first reviews developments in the Luxembourg labor market, taking into account the challenges faced by different groups of workers. Thereafter, it turns to stylized facts on the impact of the tax-benefit system on labor market performance. Finally, it presents an empirical model to assess the effect of the tax-benefit system on unemployment and activity rates.

The results indicate that low employment of older workers and women is largely driven by low participation rates among these groups, while both higher unemployment and lower participation contribute to the low employment rates of low-skilled workers. The relative importance of the different benefit schemes varies across groups of workers. The high unemployment of young and low-skilled workers reflects substantial unemployment traps inherent to the tax-benefits system, while high disincentives for second earners contribute to lower participation of women, and weak labor market attachment of seniors is predominantly driven by the generosity of the pensions system. Substantially increasing employment requires efforts to reduce skills mismatches and to make work more rewarding.

A. Overview of the Labor Market



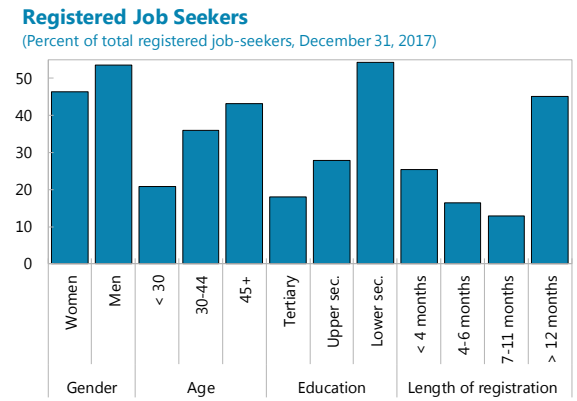
1. A decade after the financial crisis, the unemployment rate remains higher than its pre-crisis-level, and the employment rate lags behind the national target. Unemployment is low by European standards but has substantially increased compared to its historical level. For instance, in 2001, the unemployment rate was less than 2 percent or third of the average rate in neighboring countries. After a surge between 2001 and 2005, it stabilized at around 4½–5 percent during 2005–10. From 2011, the unemployment rate steadily increased, reaching a peak of 7.1 percent in 2014. Currently, it remains two percentage points or more above the pre-crisis level. The strong net employment creation also

[1] Prepared by William Gbohoui (EUR).

benefits cross-border workers who represent more than 40 percent of the employed. Meanwhile, the employment rate of workers aged 20–64 years continuously increased from 67.5 to 70.7 percent in 2016, but remains below the national target of 73 percent and also below the European objective of 75 percent.[2]

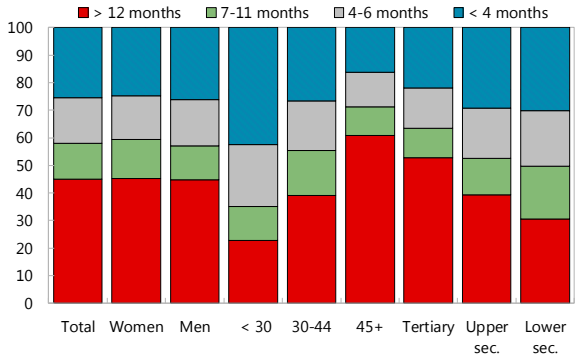
Figure 1. Unemployment and Skills Mismatches

Unemployment is prevalent and highly ...



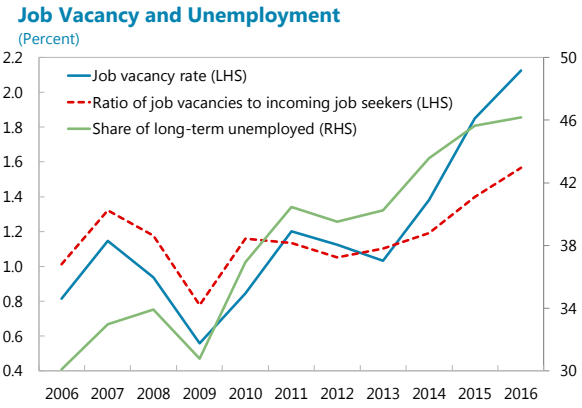
Sources: ADEM and IMF Staff Calculation.

... persistent for low-skilled, and older workers,



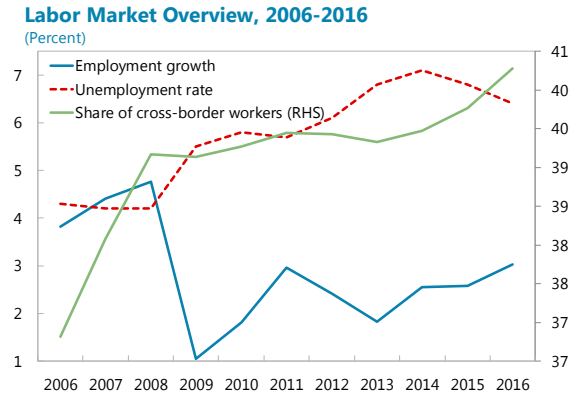
Sources: ADEM, and IMF Staff Calculation.

... despite strong net job creation going ...



Sources: ADEM, Statec, and IMF Staff Calculation.

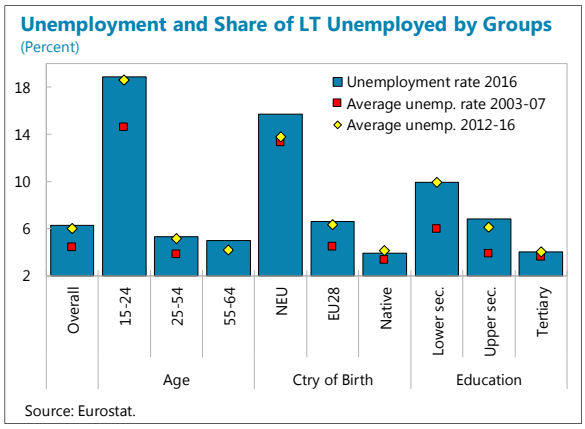
... mostly to cross-border workers.



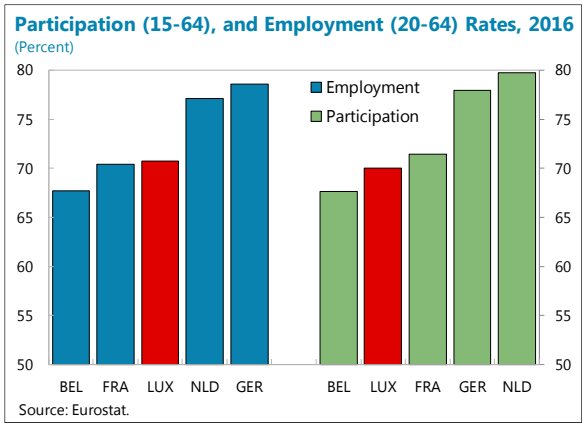
Sources: ADEM, Statec, and IMF Staff Calculation.

2. Unemployment is persistent for young, low-skilled and older workers (Figure 1). Compared to the pre-crisis period, unemployment did not change substantially for workers who hold a tertiary education degree, but has significantly increased for youth, low- and medium-skilled workers, and non-native resident workers, suggesting that these groups are facing greater difficulty to succeed in the labor market. For illustration, workers with less than a secondary education represent less than 20 percent of the labor force but more than 50 percent of registered jobseekers

[2] National Reform Program of the Grand Duchy of Luxembourg under the European semester, 2017.



at ADEM, the national employment agency, at the end of December 2017. Moreover, the share of unemployed who have been out of a job for 1 year or more has steadily increased since 2009, and accounted for more than 45 percent of the unemployed in 2016. In addition, unemployment persistence is the highest for workers older than 45 years, increasing the risk of discouragement and human capital deterioration. The recently introduced measure to facilitate employment of long-term unemployed is welcome but subsidized employment should be closely monitored to avoid providing windfalls to employers without creating durable jobs.[3]



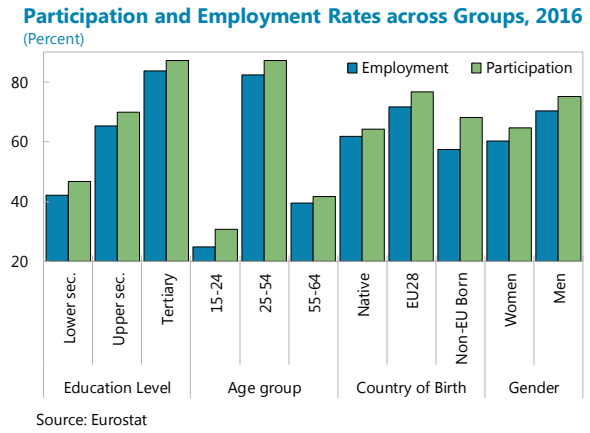
3. For these groups, participation and employment rates also lag behind those in neighboring countries. (Figure 2). The overall participation rate of 70 percent is below the neighbors' average of 74 percent. Despite innovative measures by ADEM to activate senior workers, the employment rate of older workers at around 40 percent remains far below EU peers.[4] Notwithstanding the Youth Guarantee Program as well as training and apprenticeship programs, activity rates of young and low-skilled workers are substantially below those in neighboring countries. The youth participation rate at 30.7 percent, two-thirds of the neighbors' average, is relatively low even when taking into account the high share of 18–24 years old enrolled in education. Lower participation rate of natives compared to non-natives indicates that existing skills are underused in Luxembourg. The gender gap in activity rates is close to that in the neighboring peers, but labor market attachment is marginal for women who represent more than 80 percent of part-time workers. Low participation among these groups of workers is the main factor driving their low employment, suggesting that efforts are needed to increase incentives to work.

[3] *Emploi d'insertion favorisant l'embauche d'un demandeur d'emploi de longue durée* http://www.adem.public.lu/fr/demandeurs-demploi/aides-financieres-mesures/mesures-emploi/EMI/index.html

[4] Among other initiatives, the professional classification scheme for partially incapacitated persons is reformed to keep reclassified persons at work, especially older persons. The professionalization placement program and the professional reinsertion contract give senior job seekers the opportunity to improve their knowledge and highlight their professional capabilities within a company.

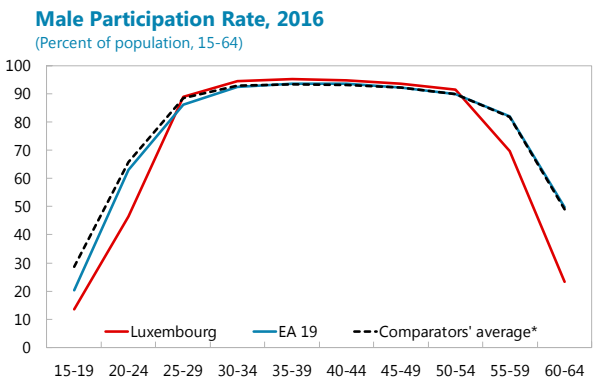
Figure 2. Participation and Employment Rates

Low participation and employment for the low-skilled …



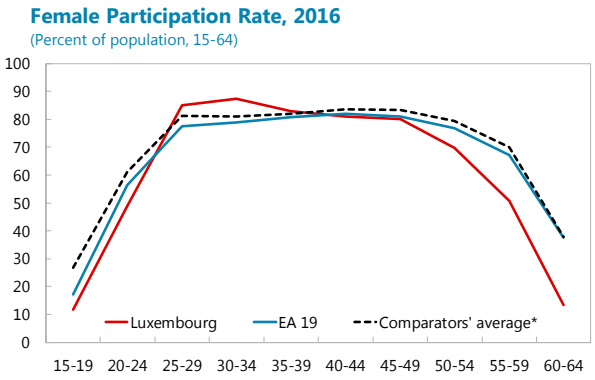
Source: Eurostat

… and both sexes at the tails of the …



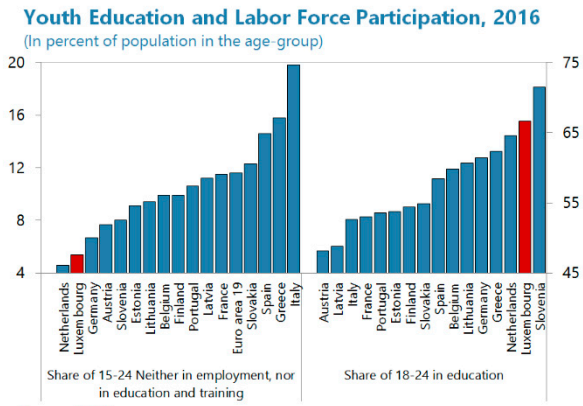
Source: Eurostat.
*Comparators include Belgium, France, Germany, and The Netherlands

… age distribution.



Source: Eurostat.
*Comparators include Belgium, France, Germany, and The Netherlands.

Most youth are in education.



Source: OECD.

4. Substantially improving the labor market prospects for these groups remains challenging due to skills mismatches and stiff competition from cross-border workers. The demand for skills is changing drastically with employment shifting further to high value-added sectors that employ high-skilled workers. Consequently, the demand for skills needed to perform abstract tasks and non-routine manual tasks has increased strongly at the expense of routine manual jobs, and this has worsened the labor market prospects of low-skilled and older workers who lack the necessary capabilities to succeed in the digital economy (Marcolin et al., 2016). Despite initiatives by ADEM,[5] the integration of the low-skilled and long-term unemployed remains

[5] The "*stage de professionalisation"* initially available to workers older than 45 years old to highlight their skills is now accessible at the age of 30. Training programs are also expanding and a new initiative, *skills bridge,* is expected to be launched in 2018.

challenging, in part due to increasing competition from cross-border workers. As a result, unemployment remains relatively high while the job vacancy rate is increasing, suggesting substantial mismatches between the qualification of the jobless and the skills required by the job openings. At the individual level, a skills mismatch could imply lower job satisfaction and a higher risk of unemployment relative to well-matched workers, and can contribute to discouragement and labor market withdrawal (Montt, 2015). At the macro-level, it can lead to high inactivity, a vicious circle because inactivity contributes to the under-utilization of skills, suggesting that reducing skills mismatches should be a key policy objective.

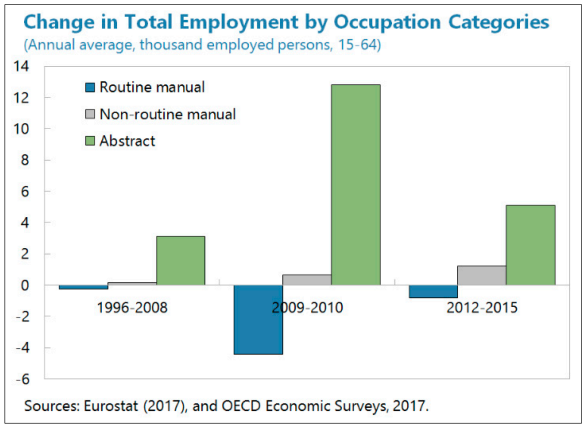
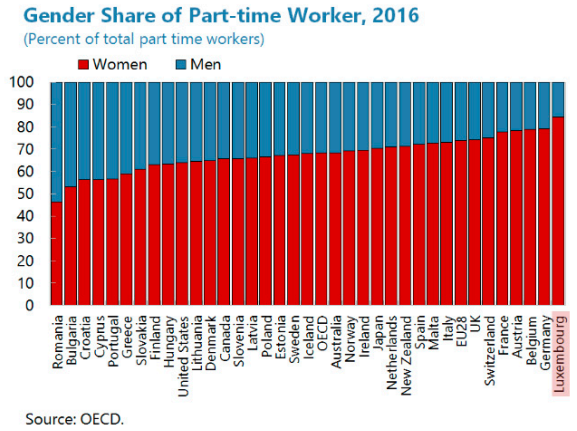
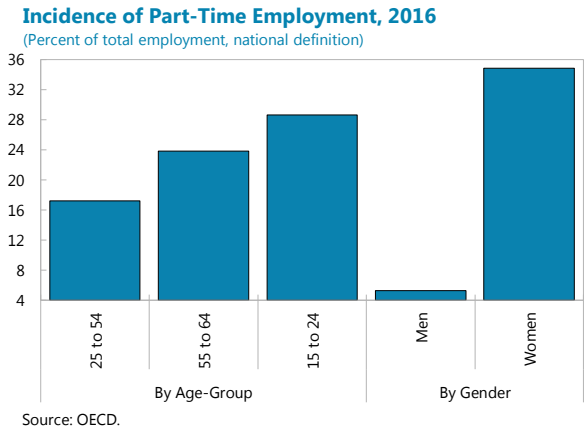


Figure 3. Incidence of Part-Time Work

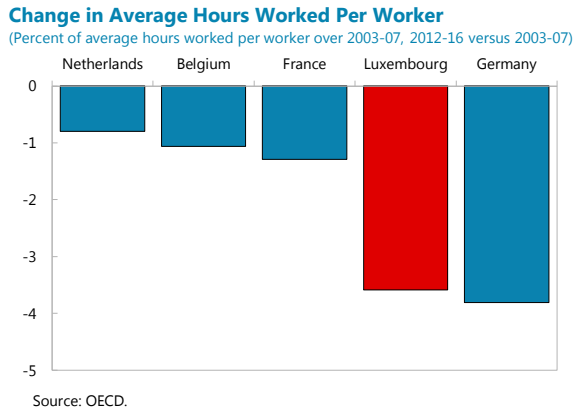
Part-time is endemic for women, ...



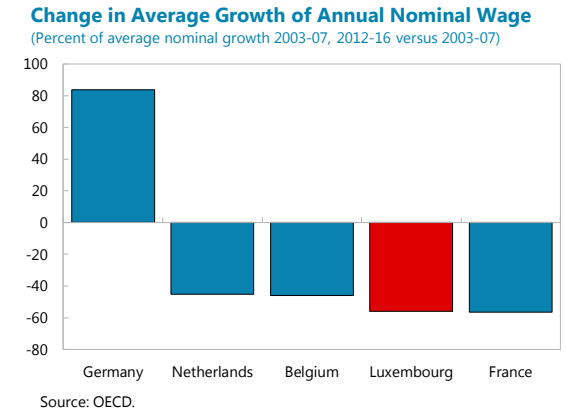
... and widespread among the young.



Hours worked have declined, ...



... and nominal wages have decelerated.



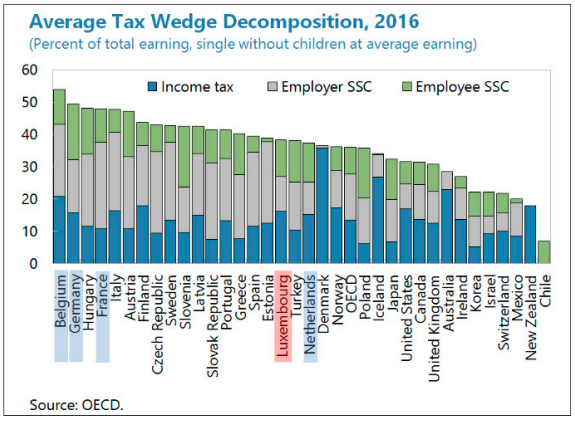
5. Given the characteristics of the vulnerable groups, Active Labor Market Policies (ALMP) alone will not suffice to substantially reduce unemployment (Figure 3). While policies to improve the matching of workers and jobs, and to avoid that the unemployed lose their attachment to the labor market are key to increasing unemployment outflows, supply side policies are also important in Luxembourg due to the particularly low participation rate of some groups. In addition, a high share of women, young, low skilled and older workers are in part-time work. Average hours worked per worker have declined compared to the pre-crisis period, more so than in neighboring countries, possibly related to the rise in part-time work. Moreover, nominal wages have decelerated, reducing the financial incentives for work, and suggesting that a broader reform of the tax and benefit system is needed to make work more rewarding, especially for low wage earners. The next section assesses the tax-benefits system in Luxembourg in comparison to other countries, and evaluates its impact on work incentives across workers' groups.

B. How Does the Tax-Benefits System Affect Work Incentives?

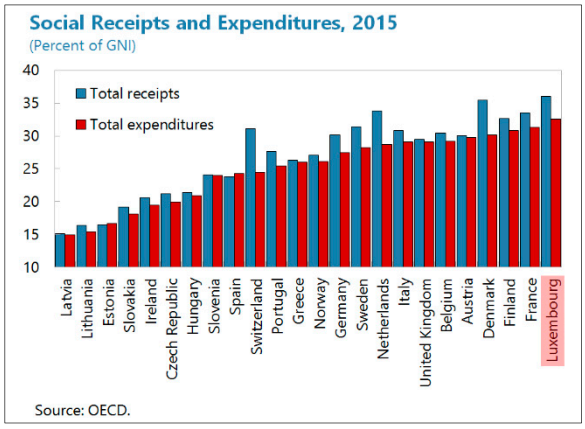
6. Two main trade-offs reside at the heart of the tax-benefit system. First governments face a trade-off between equity and efficiency. Governments want to raise tax revenue for public good provision, to redistribute income from higher to lower income individuals and families, and to provide a temporary safety net for people who are unemployed or unable to work. However, in doing so they reduce work incentives especially for low-income earners, thereby reducing labor supply and in turn the total amount of income available to be redistributed. Second, while many factors affect individual labor supply decisions, work requires a sacrifice at least of leisure, and the individual worker's decision on whether to enter the labor force, the number of hours they will work if they do enter the labor force, and how long they will stay in the labor force is underpinned jointly by the tax and benefit systems, at least in economies endowed with a safety net. The incentive problems inherent to the tax-benefits system create a work-welfare trade-off in which not working could be a rational choice if the net income increase from working does not justify the sacrifice of leisure, especially for low earners.

7. The taxation of labor income affects both the level of unemployment and the size of the labor force (Pissarides, 1998, Nickell and Layard, 1999, Bovenberg, 2006, Bassinini and Duval, 2006, 2009). Labor taxes distort labor supply and demand, and could generate lower labor market participation and higher unemployment. For instance, the interaction between the tax-benefit structure and other labor market characteristics may push wages above market-clearing levels, generating long-run unemployment. Independently of the level of unemployment, the tax and benefits system may affect the size of the labor force by reducing incentives to work, at least in the formal sector. In a nutshell, the financial incentives for people to take up work or to work longer hours, and for firms to hire new staff or grant salary increases are largely determined by the joint effects of the tax and benefits system. These financial incentives are measured through several indicators defined by the OECD tax-benefits model (Annex 1).

8. The analysis focuses particularly on low-income workers, older workers, and second earners, identified as more vulnerable to inactivity or unemployment in Luxembourg. Empirical and theoretical research suggests that the labor supply of these groups is more responsive to taxation than that of other groups of workers (Diamond, 1980; Saez, 2002; Brewer *et al.*, 2010, OECD 2011, Dorley, 2015). Diamond and Saez (2011) also find that marginal tax rates highly distort labor market supply when applied to points in the income distribution where there are many taxpayers and labor supply elasticities are large. The empirical evidence in Luxembourg supports these results and indicates that low skilled and young, mostly low-income earners have lower employment and participation rate in Luxembourg. In addition, the labor market attachment is weak for older workers and marginal for women, suggesting that these groups of workers deserve particular attention.



9. The average tax wedge is broadly in line with neighboring countries, but penalizes single parent at the margin (Figure 4). The tax wedge between total labor costs to the employer and the corresponding net take-home pay for single workers without children, at average earnings levels, is 38 percent in Luxembourg, slightly higher than the average tax wedge in OECD countries but lower than in neighboring countries. Across family situations, the lowest tax wedge is observed for one earner married couples for levels of income above 50 percent of average earnings. On average, a single person without children bears the highest tax wedge at lower income levels. Beyond 1.75 times the average earnings level, the highest tax wedge is observed for a single parent with two children. At the margin, the combined effect of increasing personal income tax, employee and employer (including payroll taxes) social contributions and decreasing cash transfers, is the highest for single parents with two children at all income levels above 60 percent of average earnings, while married couples with or without children face the lowest marginal tax wedge at all levels of earnings.

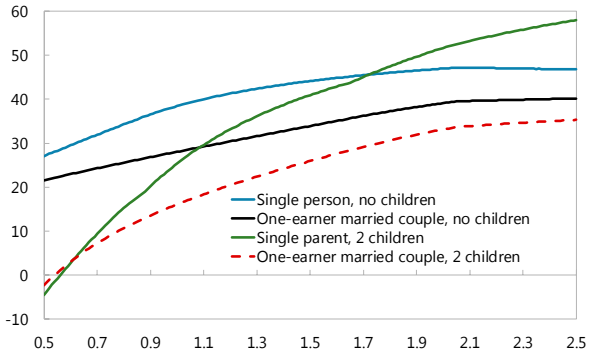


10. Social spending is substantial in Luxembourg, with a high share of family benefits. Total social spending, at 32.6 percent of GNI, is among the highest in Europe reflecting in particular sizable old age pension benefits. Compared to other countries, Luxembourg has the highest share of family benefits expenditure, mirroring the generous family/children benefits embedded in the tax and benefits system.

Figure 4. Tax Wedge and Social Spending

Labor taxation favors couples,

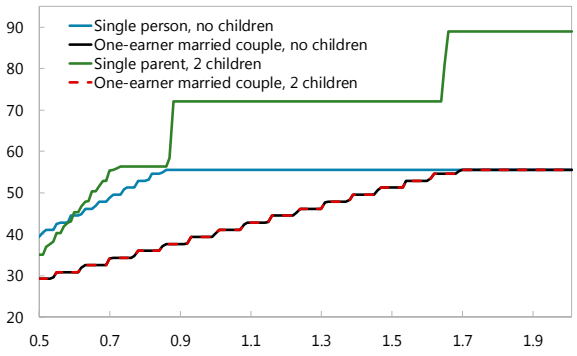
Average Tax Wedge Across Income Levels, 2016
(In percent of of total earnings)



Sources: OECD.

... at the expense of single parents.

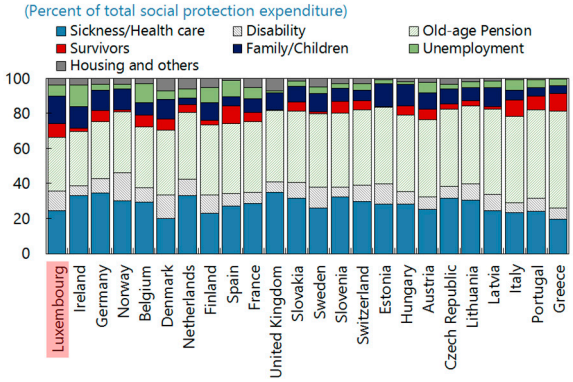
Marginal Tax Wedge, 2016
(In percent of total earnings)



Source: OECD.

The social system is large, ...

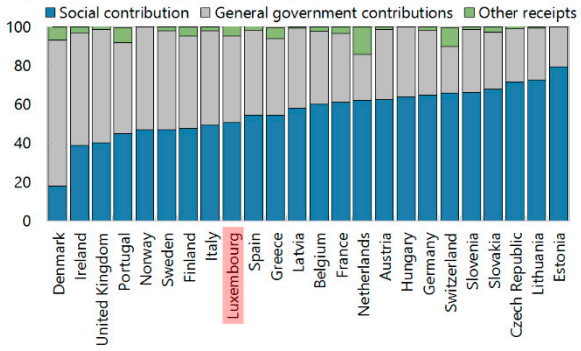
Social Protection Expenditure by Functions, 2015
(Percent of total social protection expenditure)



Sources: OECD, Eurostat, and Staff Calculation.

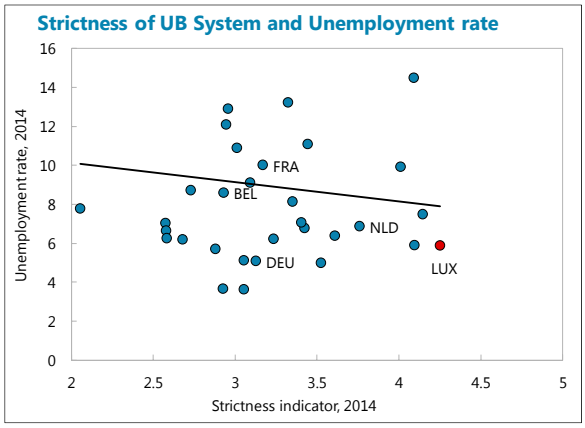
... offering a broad set of benefits.

Social Protection Receipts by Types, 2015
(Percent of total social protection receipts)



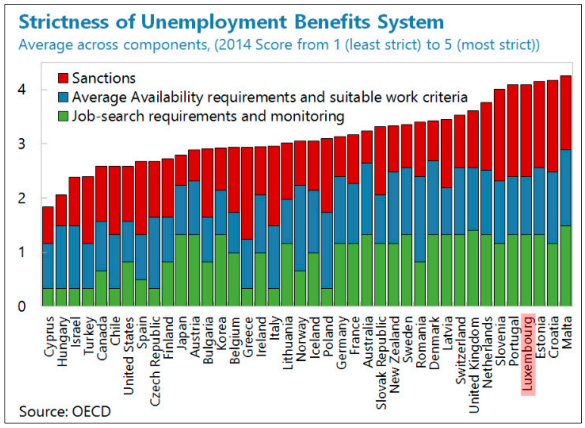
Sources: Eurostat, OECD and IMF staff calculation.

11. Effective implementation of tighter entitlement and eligibility criteria could act as a positive incentive for participation

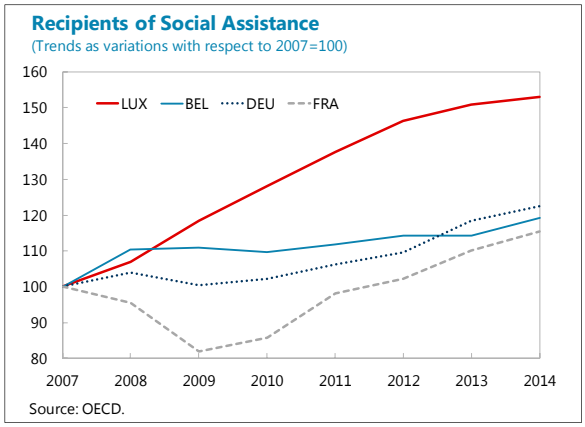


(Langenbucher, 2015). Empirical evidence shows that countries with more stringent unemployment benefit systems are more likely to record lower unemployment levels. The impact of eligibility criteria on employment outcomes and benefit recipient status relies heavily on the implementation of activation measures in which participation is required, for example the procedures for reporting and verification of job search and obligations to participate in ALMPs. Initial entitlement criteria reduce unemployment inflows as they may exclude certain groups from receiving unemployment benefits, while ongoing eligibility may increase outflows by specifying the

requirements for remaining eligible for unemployment benefits (Immervoll and Richardson, 2011). Together, entitlement and eligibility criteria are destined to counter the work disincentive effects. Benefit generosity is measured by the benefits level and duration. Maximum duration is important because longer duration may generate benefit dependency and increase unemployment duration especially for low income earners, but also for older workers with a long contribution period (Krueger and Meyer, 2002 Van Ours and Vodopivec, 2005, Lalive, 2008; Caliendo et al., 2009). The level of income is a key element of the architecture of unemployment benefits systems as high replacement levels create financial disincentives to work (. Layard et al, 1991, Nickell, 1998; Krueger and Meyer, 2002).



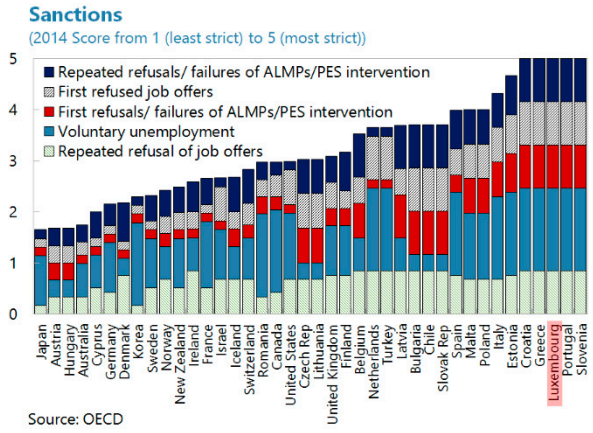
12. In Luxembourg, entitlement and eligibility criteria, and benefits duration are close to those in most European countries (Figure 5). Eligibility criteria refer mainly to a range of behavioral requirements which must be met to establish a right to receive unemployment benefits. Unemployment benefits' entitlement and eligibility criteria in Luxembourg are among the strictest across OECD countries, reflecting the continuous adaptation of AMLPs by ADEM Figure 6). In particular, the sanctions that may be imposed on jobseekers in cases of voluntary unemployment, refusal of a "suitable" job offer, or failure to participate in ALMPs are the most strict across countries. Available information indicates that the maximum duration of unemployment insurance is 12 months in Luxembourg, as in Germany, against 24 months in France.



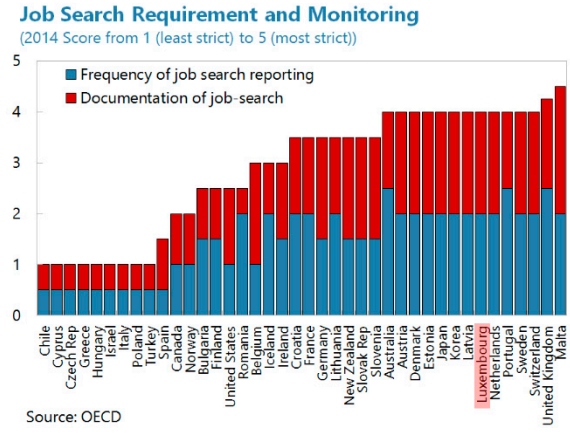
13. But the number of benefit recipients has grown at a faster pace than in neighboring peers except for disability benefits. As in most countries, the surge in the number of unemployed since 2007 is almost matched by an equally strong increase in the number of unemployment-benefit recipients. In 2014, the number of unemployment-benefits recipients was more than 1.5 times the number of recipients in 2007 for Luxembourg, the fastest increase among neighboring peers. As more people are becoming long-term unemployed, many of them have exhausted their unemployment benefits and turned to social assistance for income support, resulting in a fast growth of recipients of social assistance. While the number of recipients of old-age pensions grew at the same pace or slower than the

Figure 5. Strictness of the Unemployment Benefit System

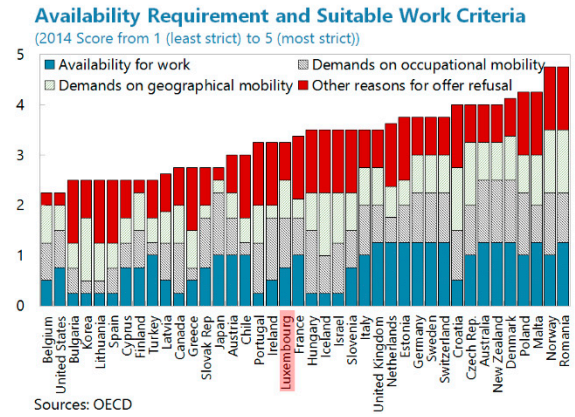
Sanctions are stricter than ...



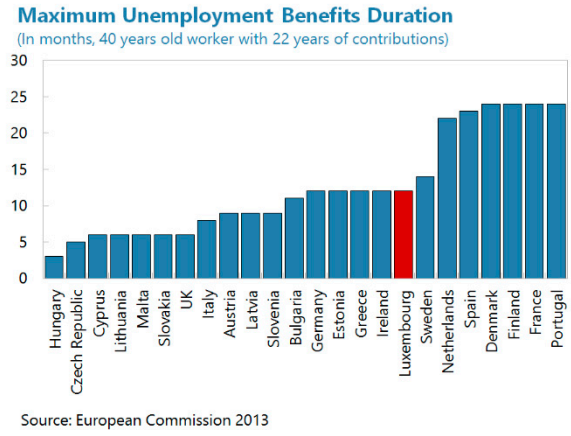
... job search and ...



... availability requirements.



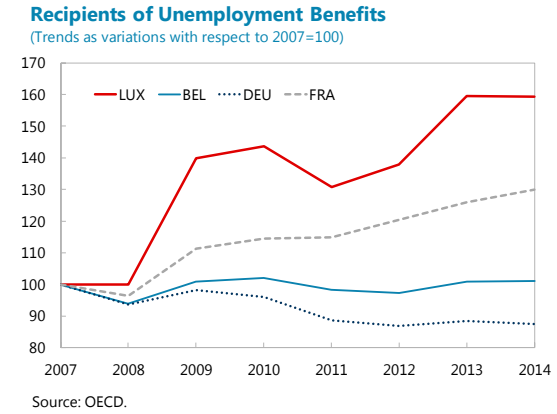
Benefit duration is in line with peers.



elderly population in most neighboring countries, the rise was significantly higher in Luxembourg, suggesting that many people are benefiting from early retirement schemes. In contrast to Belgium, Germany or France where the number of disability benefits recipients increased, it fell in Luxembourg. This downward trend is more likely to be driven by the reclassification program which re-integrates partially disabled workers to the labor market.

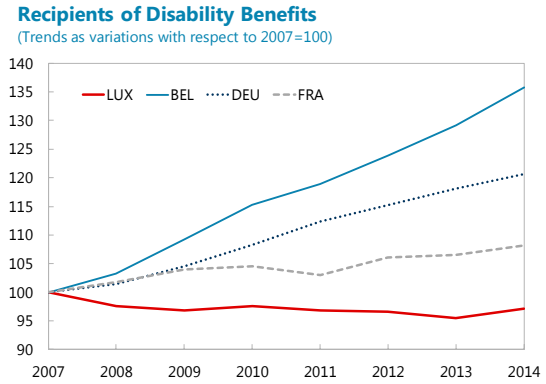
Figure 6. Trend in the Recipient of Social Benefits

Increasing recipients of unemployment benefits



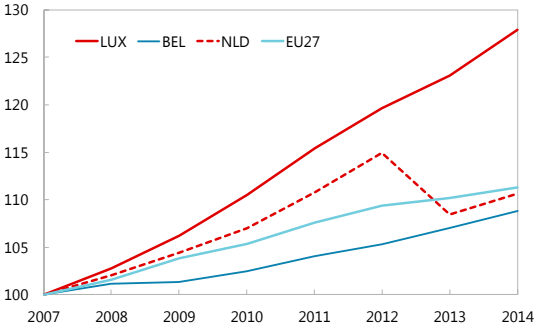
Source: OECD.

Declining of disability benefits receivers



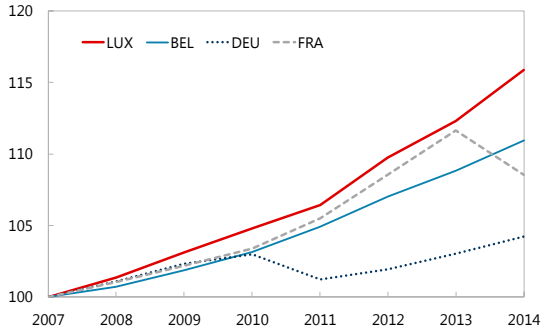
Source: OECD.

Beneficiaries of pensions have grown …



Source: OECD.

… faster than the old-age population.



Source: OECD.

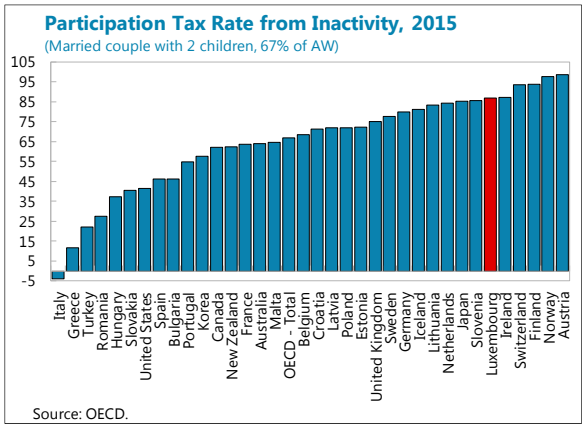
14. The social safety net in Luxembourg is large, covering a broad set of benefits. It consists of a means-tested guaranteed minimum income (RMG) and covers a broad range of unemployment, health, sickness, maternity, child, family, housing, disability, old-age and invalidity pension benefits[6] Of the 10,087 households which received the RMG in 2016, almost 55 percent are single-person households, a higher proportion than their share in the total population.[7] A planned reform of the RMG will replace it by the Social Inclusion Income (REVIS). The new benefit scheme consists of two part—the inclusion allowance and the activation subsidy—and introduces the condition of being registered as a jobseeker with ADEM, while providing controls and anti-fraud

[6] For further details on the Luxembourg's tax and benefit systems, please refer to 2016 EUROMOD Country Report – Luxembourg, European Commission, 2017.

[7] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwinkMO8gu3ZAhXrxlkKHdvlC80QFggrMAA&url=https%3A%2F%2Fsnas.gouvernement.lu%2Fcontent%2Fdam%2Fgouv_snas%2Fpublications%2F2016-rapport-activite-snas.pdf&usg=AOvVaw2CCM6lBG1G4motmmAg-_Ba

(continued)

measures to limit subsidy dependency.[8] To dissuade beneficiaries from the idea that it is preferable to live on state subsidies rather than looking for work, REVIS beneficiaries can work more than ten hours a week, and 25 percent of the possible income will not go towards the calculation of the amount of compensation.

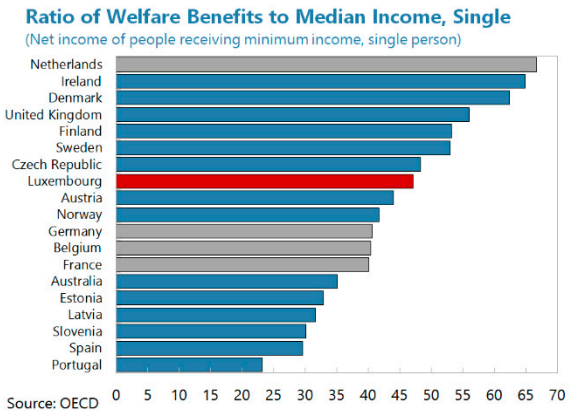


15. Welfare benefits are generous enough to possibly make not working a rational choice for low earners (Figure 7). The welfare system in Luxembourg is more generous than in most neighboring. While receiving benefits equivalent to almost 50 percent of median income for not working, some individuals might choose to remain out of work as working bears the additional burden of paying taxes on earned income. Participation tax rates are among the highest in OECD countries for inactive people when they take a full-time job, especially at a low wage, creating substantial inactivity traps. As illustration, for a one-earner married couple with 2 children taking a job at 67 percent of the average wage, taxes and benefits reduce the financial gain by more than 86 percent. Given the expenses associated with work and the loss of leisure and family time, not working could be a rational choice if the increase in net income does not justify the sacrifice.

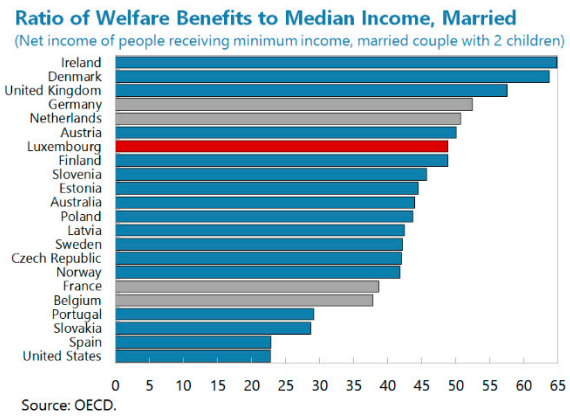
[8] For more details on the reform, please refer to the draft law n°7113 http://www.chd.lu/wps/portal/public/Accueil/TravailALaChambre/Recherche/RoleDesAffaires?action=doDocpaDetails&backto=/wps/portal/public/Accueil/Actualite&id=7113;http://www.luxembourg.public.lu/en/actualites/2017/12/31-nouveautes-2018/index.html.or to https://luxtimes.lu/archives/3532-luxembourg-s-minimum-income-scheme-is-about-to-change

Figure 7. Inactivity Traps

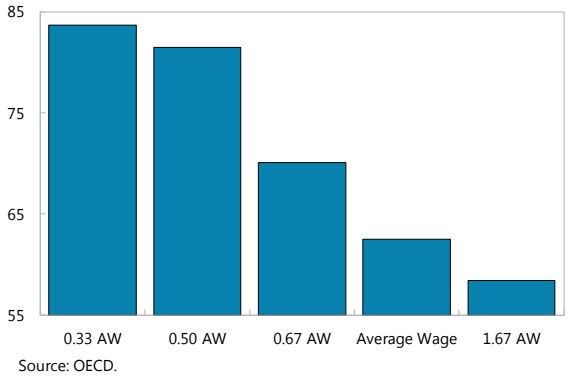
Benefits are generous across family situations, …



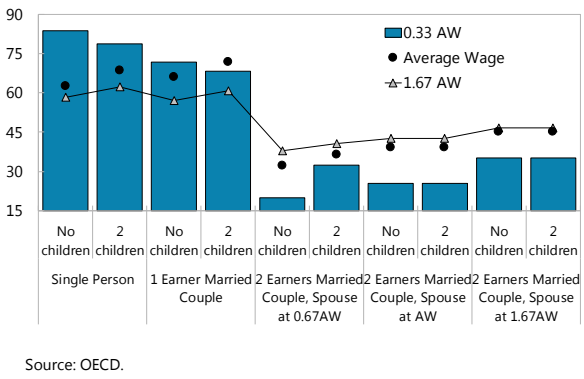
… and closer to northern Europe social system.



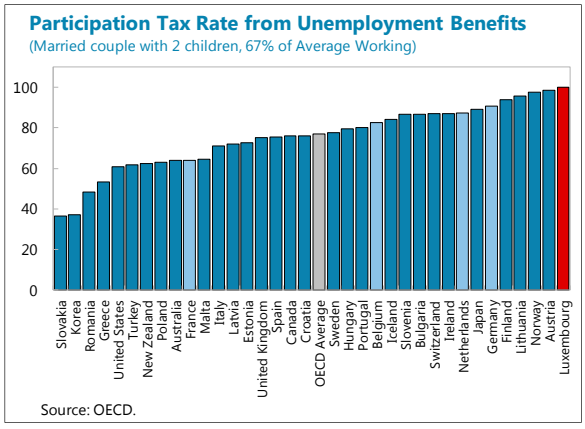
Work disincentives are high for low-earners, …



… especially for single person and 1 earner couple.



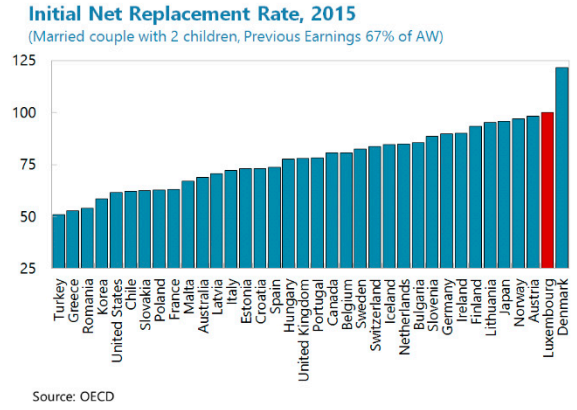
16. Generous unemployment benefits reduce incentives to actively search and take up jobs, especially for some family situations



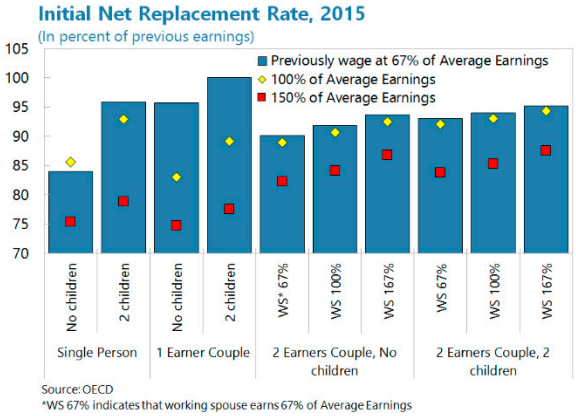
(Figure 8). Generous unemployment benefits might reduce incentives to work and create long-term benefit dependency (Mortensen, 1997; Shavell and Weiss, 1979). In addition, Krueger and Meyer (2002) conclude that a 10 percent increase in unemployment benefits raises the average duration of unemployment by around 5 percent and that the impact is likely much higher in countries with relatively weak eligibility condition s. In Luxembourg, unemployment benefits, measured by net replacement rates, are relatively generous, with an initial net replacement rate among the highest across OECD countries. For instance, a one-earner married couple with 2 children

Figure 8. Unemployment Traps

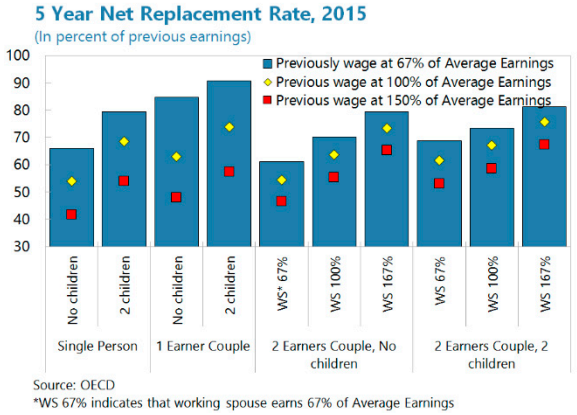
High replacement rates …



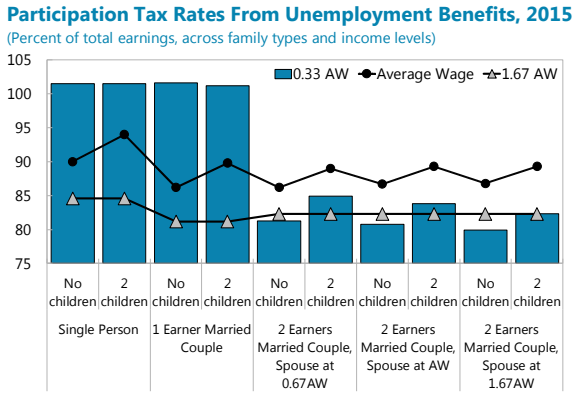
… irrespective to …



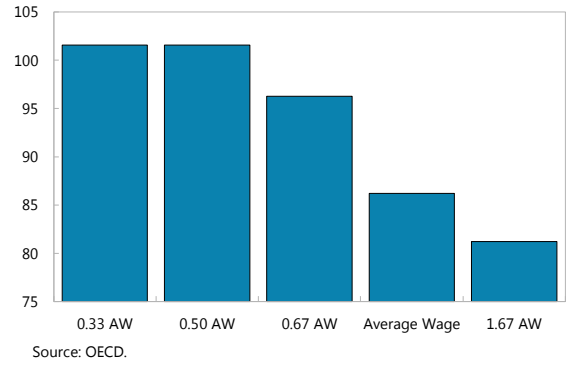
… the horizon considered, …



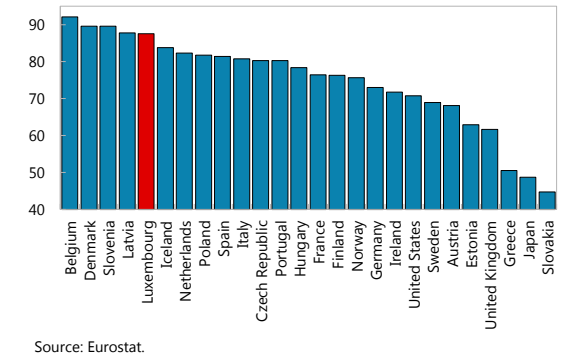
… discourage work for some family situations, …



… especially at low wages,…

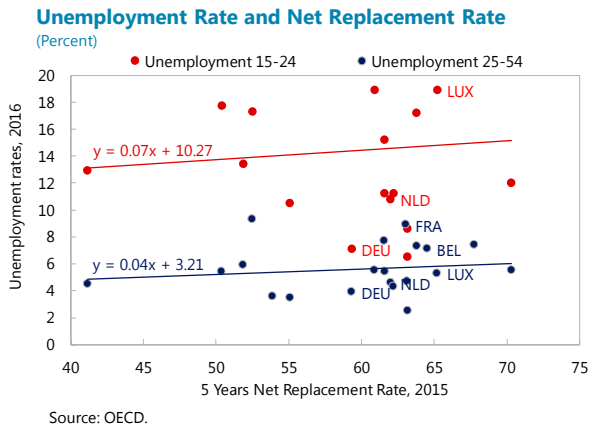


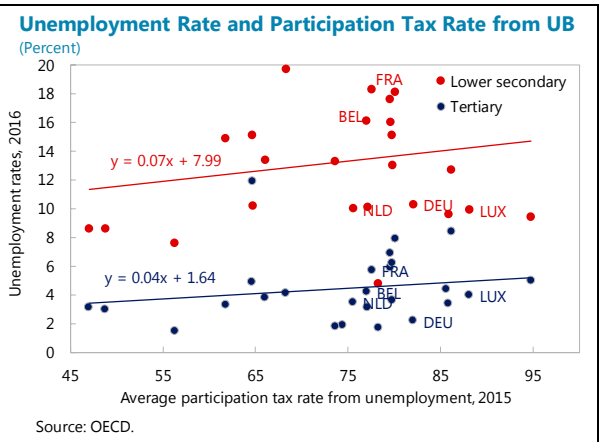
… generating considerable unemployment traps.



earning previously 67 percent of the average wage[9] is better-off living on unemployment benefits than taking a job as its net replacement tax rate is more than 100 percent. Such a high participation tax rate reduces the incentives to look for a job when unemployed, and generates unemployment traps especially for low-skilled, low-wage workers.

17. The labor supply of young, and of low-skilled workers is particularly sensitive to the generosity of the tax benefits system. Cross-country scatter plots suggest that higher unemployment rates are more likely to be observed in countries with more generous unemployment benefit systems, although the correlation is relatively weak. Across age-groups, the elasticity of the unemployment rate to the generosity of the tax benefits system is higher for young workers than for prime-age workers. In the same vein, the unemployment rate of workers with lower secondary education is more responsive to the generosity of the unemployment benefits system than that of workers with a university degree. One reason is that as high skilled-workers earn high wages, they are less likely to be content with unemployment benefits and actively search for a new position when they lose their job.





18. High marginal effective tax rates (METR) reduce incentives to work more hours, generating low-wage traps (Figure 9). Cross-country comparison suggests that higher METR are associated with higher shares of women working part-time. In Luxembourg, METR are high across family situations for part-time workers, especially at the bottom of the income distribution. Among OECD countries, it is the highest for a one-earner married couple with two children who will not obtain any increase in net income, after accounting for the loss of benefits, when increasing work hours from 33 percent to 67 percent of the average wage as its METR is more than 100 percent. With such METRs, it is not surprising that part-time work is widespread, especially among women.

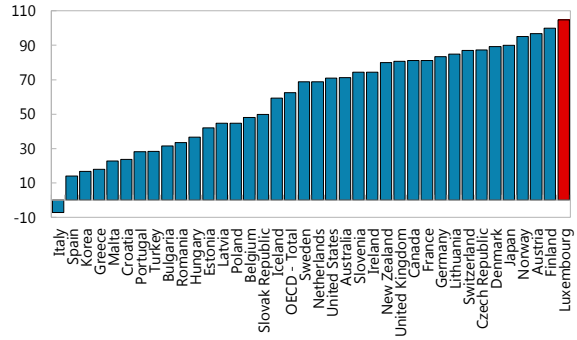
[9] For 2015, the average wage used in the OECD tax-benefit model is 55,858 euros for Luxembourg.

Figure 9. METR and Low-Wage Trap

High METRs for across …

Marginal Effective Tax Rate, 2016

(From 33% to 67% of AW on increasing working hours, married couple - 2 children)

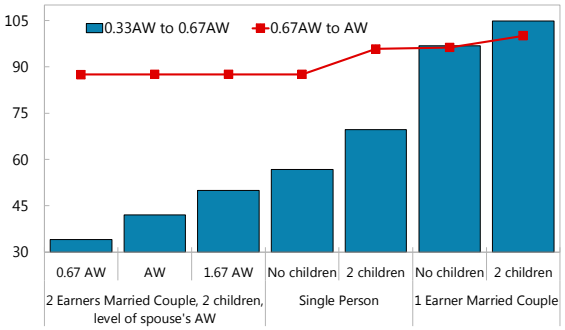


Source: OECD.

family situations,

Marginal Effective Tax Rates, 2015

(Percent of total earnings, across family types and income levels)

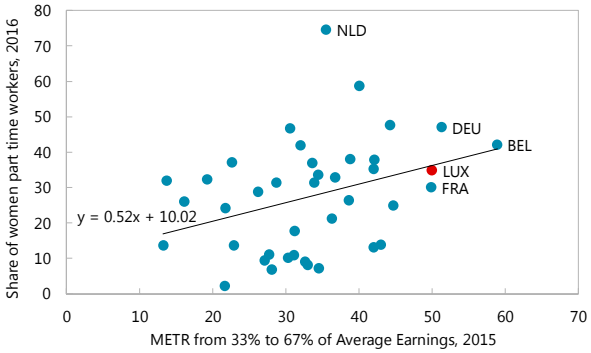


Source: OECD.

… discourage workers, especially …

Part-time Work and Marginal Effective Tax Rate

(Second earner, married couple with two children, spouse at 167% of AW)

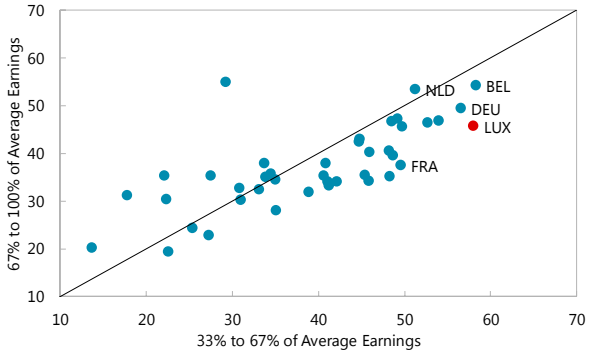


Sources: OECD and IMF Staff Calculation.

… low earners, from working more hours, …

Marginal Effective Tax Rates, 2015

(Increasing hours, average across family situation)

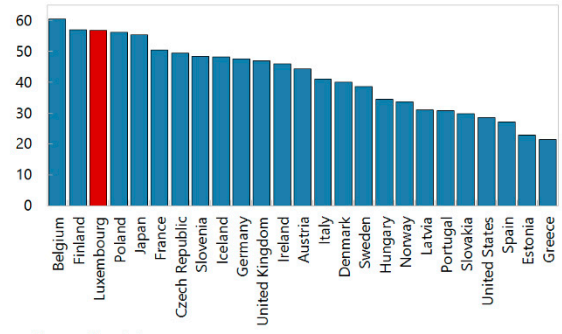


Sources: OECD and IMF Staff Calculation.

… generating substantial …

Low-Wage Traps, Single Person without children, 2015

(Tax rate on single person without children, 33% to 67% of AW)

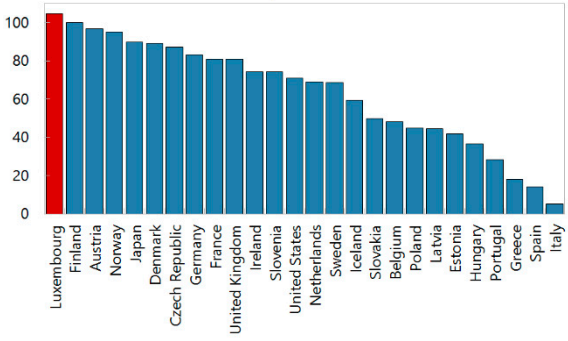


Source: Eurostat.

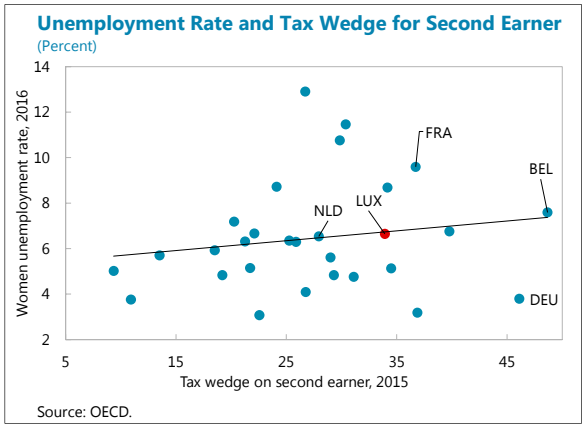
… low earners, from working more hours, …

Low Wage Traps, Married Couple with 2 Children, 2015

(Tax rate on one-earner married couple with 2 children, 33% to 67% of AW)



Source: Eurostat.



19. Work disincentives are substantially high for second earners. Empirical evidence highlights the high elasticities of hours worked elasticities of second earners, mostly women, to the disincentives inherent to the tax benefits system. Cross-countries scatter-plot indicates that higher tax wedges on second earners are associated with higher unemployment rate for women working part-time. This result suggests that hours worked by second earners, mostly women, are responsive to the tax disincentives inherent to the tax benefits system corroborating the existing empirical evidence. The 2016 tax reform will likely have a limited impact on the tax wedge on second earners, although, evidence from policy changes in several countries indicate that breaking the link between a husband's income and a wife's tax rate increases female labor market participation.[10] For instance, any additional incentive received by the second earner under the optional individual taxation is at the cost of the principal earner, mainly because the tax scale applied to the first earner under the joint taxation is more favorable than that under individual taxation implicitly subsidizing couples who file jointly. Further steps are then needed to increase work incentives for women.

20. Further expanding the daycare and after-school programs could improve the labor market attachment of women (Figure 10). There is a clear consensus from the literature that the labor market participation of women, especially lone mothers, is highly responsive to work incentives.[11] In Luxembourg, the net cost of childcare bore by workers are relatively high, reducing incentives for women with young child to participate to the labor market. The recently introduced free weekly 20 hours multilingual childcare is a step in the right direction. Additional steps to enlarge the availability of daycare and after-school programs could further encourage women labor market participation.

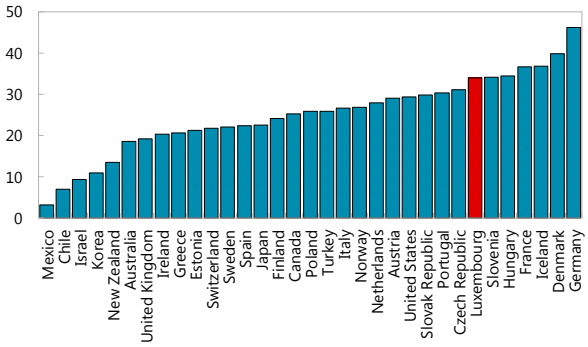
[10] The cases of Canada, the United States, the Czech Republic, and Sweden are assessed in Crossley and Jeon (2007), LaLumia (2008), Kaliskova (2014), and Selin (2014), respectively.

[11] Brewer et al. (2006); Keane and Moffitt (1998), and Eissa and Liebman (1996) report higher elasticity for women than for men, and for lone mothers than for married women. Arrufat and Zabalza (1986); Pencavel (1998), and Aaberge et al (1999) find that elasticities are higher for women in poorer household.

Figure 10. Work Incentives for Women

High tax wedge on second earners, …

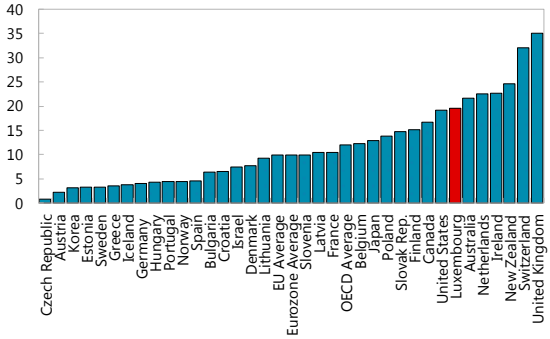
Net Personal Average Tax Rate on Second Earner, 2015
(Percent of total earnings, at 67% of AW (primary earner at AW), no children)



Sources: OECD and Thomas and O'Reilly (2016).

… and expensive childcare …

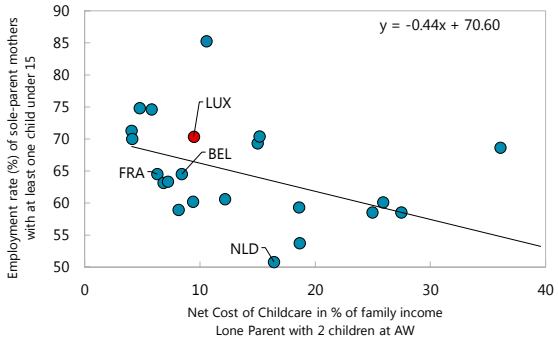
Net Cost of Child Care of Two Earners Couple, 2015
(Percent of family net income; 2 children, each member at average wage)



Source: OECD

… discourage women participation, …

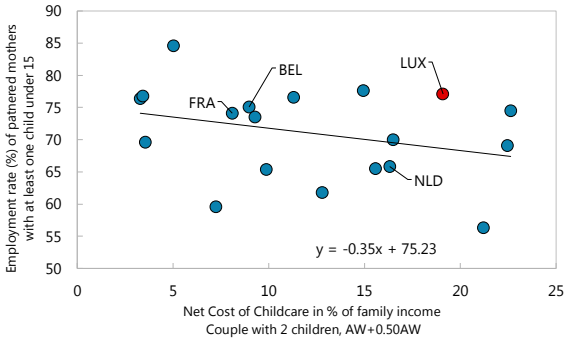
Sole-Parent Mothers Employment Rate and Childcare Cost
(2015, or the latest)



Source: OECD

… reducing their employment.

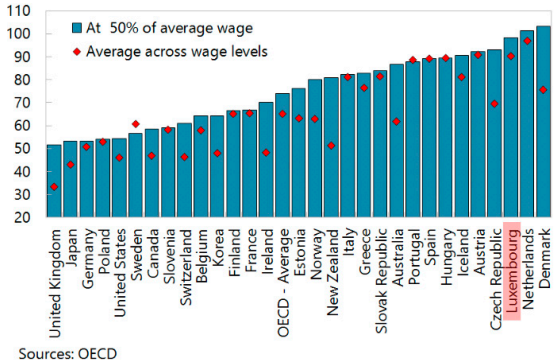
Partnered Mothers Employment Rate and Childcare Cost
(2015 or the latest)



Source: OECD

21. Incentives for older workers to keep working should also be improved (Figure 11). While the decision to work or retire is likely to be influenced by many factors, empirical evidence suggests that the financial incentives to retire faced by older workers play a significant role both for men and women. Taxation will affect the financial incentive to retire by affecting both the financial return to continued work, and the level of net retirement income. In Luxembourg, the generous pension system with several options of early retirement discourages older workers' labor market participation, excites them to exit early, and generates lower duration of work life.

Average Net Pension Replacement Rate, 2014
(Percent of Earnings)



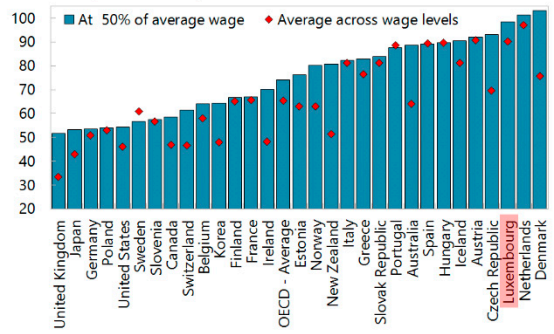
Sources: OECD

Figure 11. Work Incentives for Older Workers

Generous pension benefits discourage …

Net Pension Replacement Rate for Male, 2014 or latest

(Percent of previous earnings)

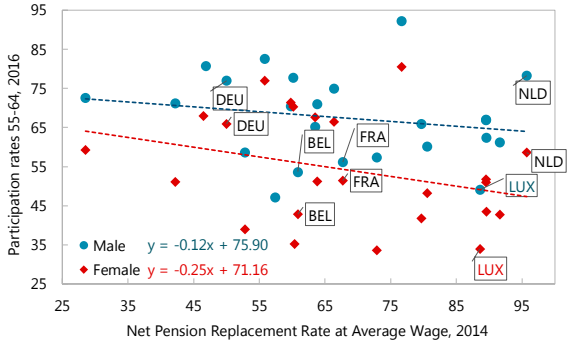


Source: OECD

… older workers' labor market participation, …

Older Worker Participation and Net Pension Replacement

(Percent)

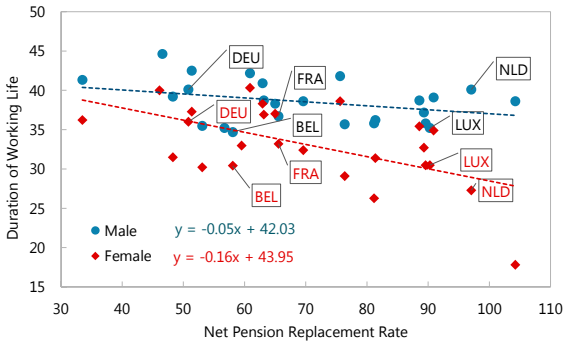


Sources: OECD and Eurostat.

… who reduce their working life, …

Duration of Working Life and Net Pension Replacement

(Years; Percent)

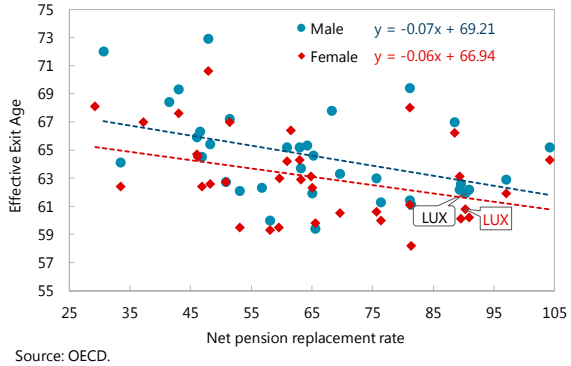


Sources: OECD and Eurostat.

… and exit the labor market earlier, …

Pension Replacement Rate and Effective Exit Age

(2014 or the latest)

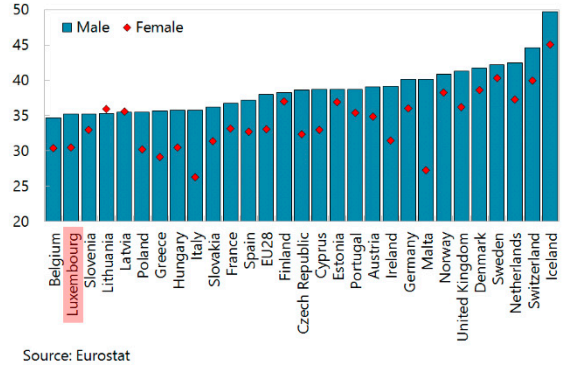


Source: OECD.

… implying shorter average working life …

Duration of Working Life, 2016

(Years)

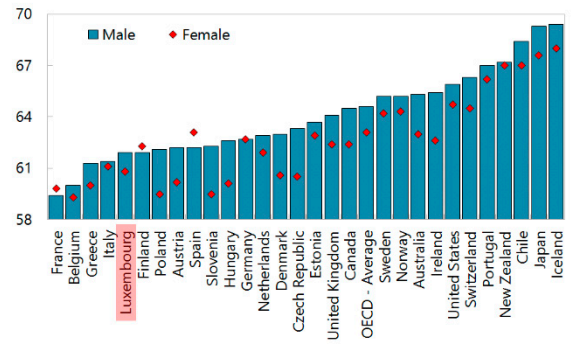


Source: Eurostat

… and effective retirement age.

Effective Labor Market Exit Age

(Years, 2014 or latest)



Source: OECD

C. Modeling the Effects of the Tax-Benefits System on Labor Market Outcomes

To assess the role of tax and benefits systems on labor force participation and unemployment, this section estimates and compares, across specific groups of workers, the relationship between these variables.

22. Related literature. The vast literature on labor supply offers a large number of models, with various explanatory factors, depending on the group of workers considered. Blanchard and Wolfers (2000), Bassanini and Duval (2006, 2009), de Serres and Murtin (2012, 2014), and Gal and Theising (2015) among others study the drivers of unemployment/employment for different groups. Jaumotte (2003), Duval (2004), Duval et al (2012), Christiansen et al (2016), Olivietti and Petrangolo (2017), and WEO (2018, forthcoming) analyze the determinants of labor market participation.

23. Empirical specification. To assess the role of tax-benefits structure, this section estimates a reduced-form specification of labor market participation (or unemployment) that relate the participation (or unemployment) rate of specific groups of workers to indicators of tax-benefits system, controlling for all differences across countries that are constant over-time and all shocks affecting equally all countries. Although the potential set of drivers of participation and unemployment rates is large and their importance may vary across worker groups, the analysis focuses predominantly on tax-benefits factors. More precisely, the analysis is based on the estimation of the following equation:

$$LMI_{k,t}^{g} = \beta^{g} X_{k,t}^{g} + \delta^{g} Z_{k,t}^{g} + \gamma_{k}^{g} + \theta_{t}^{g} + \varepsilon_{k,t}^{g}$$

in which $LMI_{k,t}^{g}$ refers to the labor market indicator—here participation rate or unemployment rate—of worker group g in country k at time t. X represents the set tax-benefits indicators considered in the analysis – the participation tax rates from unemployment or inactivity, the tax wedge, and the net replacement rate of unemployment benefits over 5 years. Z includes an indicator of the cyclical position of the economy (output gap/GDP growth rate) and other determinants of labor supply (share of population with secondary/tertiary education).

24. Data, sample, and variable definition. The estimation sample covers 35 advanced OECD countries over the period the period 2001–15. Tax-benefits indicators come from the OECD tax-benefits data and are simple-averages across all levels of income and all family situations to focus on measures that are comparable for all groups of workers. The groups include the whole working age population (15–64), as well as the following subgroups: young (15 to 24), prime-age (25–54), and senior (55–64); education attainment: low secondary, upper secondary, and tertiary; and gender: women and men.

25. Estimation strategy. The reduced form equation is estimated using cross-country panel regressions with country and time fixed effects. The standard errors are corrected using Hubert/White method to control heteroskedasticity and intragroup correlation. The use of

cross-country panel regression provides average elasticities for the set of countries in the regression sample which may not be necessarily appropriate for all individual countries in the sample. To address this issue, the analysis re-conducts the estimations while excluding Luxembourg from the country sample. The results remain broadly unchanged, suggesting that the estimated coefficients are appropriate for Luxembourg. In addition, we augment the baseline specification with an interaction term between tax-benefits variables and a country dummy for Luxembourg. For almost all the results, the coefficient on the interaction term is not statistically significant, implying that the cross-country coefficient is valid for the individual case of Luxembourg. The results for the baseline specification are presented below.

26. Results. The estimated coefficients describe how changes in taxes and benefits cause changes in the unemployment rate or labor force participation. Table 1 (respectively Table 2) presents the effects of a 1-percentage point increase in each indicator of work disincentives on the unemployment rate (respectively the participation rate) across groups of workers in Luxembourg.

27. On average, a 10-percentage points reduction in the participation tax rate from unemployment benefits would reduce the overall unemployment rate by 2.2 percentage points. A similar reduction in the net replacement rate of unemployment benefits would lower the unemployment rate by 2.6 percentage points. The highest elasticity is estimated for the tax wedge: a 10-percentage reduction in the average tax wedge would reduce the unemployment rate by 3.3 percent.

Table 1. Effects on Unemployment Rate
Dependent Variable: Uneployment Rate

Groups	Average Participation Tax Rate from Unemployment Benefits	Average Tax Wedge	Average 5-Years Net Replacement Rate
Age			
15-64	0.221***	0.327*	0.264***
15-24	0.446***	0.726**	0.556***
25-54	0.191**	0.298**	0.230***
55-64	0.151**	0.304**	0.203***
Education attainment			
Lower Secondary	0.227**	0.247	0.338**
Upper Secondary	0.224**	0.356*	0.300***
Tertiary	0.069	0.113	0.120***
Gender			
Men	0.246***	0.404**	0.312***
Women	0.180**	0.221	0.208***

*Note: ***, ** and * denote significant at 1%, 5% and 10% respectively.*

28. These aggregate elasticities conceal significant differences among sub-groups of workers. Across age-groups, the elasticity of the youth unemployment rate to the tax benefits system is more than double that of prime-age or older workers, irrespective of the indicator considered. Between skill groups, low-skilled workers are more responsive to the financial disincentives inherent in the tax-benefits structure than high-skilled workers. Men's unemployment rate has a relatively larger elasticity than that of women. This gap could be explained by the fact that the female labor supply is more determined by other factors such as the accessibility of childcare, and the size of spouse-dependent and family benefits.

29. Only the labor supply of older workers is significantly responsive with the correct sign to either the participation tax rate from inactivity, or the tax wedge. More precisely, a 10-percentage point reduction in the participation tax rate from inactivity would increase the seniors' labor market participation rate by 3.6 percentage points. The responsiveness of the older workers' activity rate to the tax wedge is even higher. The relatively high elasticity of seniors' labor supply to financial disincentives mirror the generosity of the pension system as well as the existence of early retirement options.

Table 2. Effects on Participation Rate
Dependent Variable: Participation Rate

Groups	Average Participation Tax Rate from Inactivity	Average Tax Wedge
Age		
15-64	0.029	-0.108
15-24	0.059	-0.216
25-54	0.061	-0.095
55-64	-0.363***	-0.729***
Education attainment		
Lower Secondary	-0.030	-0.055
Upper Secondary	0.067	0.080
Tertiary	0.103	-0.075
Gender		
Men	0.012	-0.181**
Women	0.153***	0.022

*Note: ***, ** and * denote significant at 1%, 5% and 10% respectively.*

D. Conclusions

30. Overall job creation is strong, but unemployment of young and low-skilled workers declines only gradually and activity rates of women and seniors remain low. Despite robust employment growth, resident employment remains below the national target, and lags behind European peers, and a rising share of unemployed workers face longer spells without a job. Compared to the pre-crisis level, unemployment has increased for young, low skilled, and non-native resident workers, and is highly persistent for seniors. Labor market attachment is weak for seniors, and marginal for women who work mostly part-time.

31. Skills mismatches are a predominant factor in explaining structural unemployment, but work disincentives inherent to the tax-benefits system are also important. Weakening demand for routine manual jobs increases unemployment persistence, especially for low-skilled workers. High unemployment rates among the young and low-skilled reflect significant unemployment traps. The relatively low participation rate of women and the high gender-gap in part-time work mirror the high marginal effective tax rates for second-earners, especially at lower wages. Low participation of seniors is driven by the generosity of the pension system.

32. Making work more rewarding, especially for low earners, would improve their employment prospects. Refocusing unemployment and welfare benefits to promote active job search and vacancy acceptance, and a greater use of in-work tax credits would ensure that the unemployed are better off taking up a job than remaining unemployed, and hence reduce unemployment traps, especially for the low-skilled. The introduction of the *Revenu d'Inclusion Sociale* (REVIS) is a step in this direction.

33. Improving participation of women and seniors. The 2016 tax reform has introduced optional individual taxation for married or co-habiting workers. Consideration should be given to

increasing the second-earner income tax-deduction. Moving to fully individual income taxation would make the tax system more gender neutral by reducing the marginal tax rate applied to the earnings of second earners, often women. Further expanding the availability of daycare and after-school programs could also improve women labor market participation. Raising the participation of seniors would also require limiting access to benefits for early retirement.

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Annex I. Definition of Tax and Benefit Indicators[1]

Financial incentives to work or to hire can be captured through several tax and benefits indicators mainly defined by the OECD. This annex focuses mainly on those used in this chapter.

The **total labor cost** is the sum of gross wage earnings of employees, employer social security contributions and – in some countries – payroll taxes.

The **personal average tax rate** is defined as income tax plus employee social security contributions as a percentage of gross wage earnings.

The **net personal average tax rate** is the personal income tax and employee social security contributions net of cash benefits as a percentage of gross wage earnings. The **net personal average tax rate of the second earner** is the increase in income tax and employee social contributions (net of in-work benefits) paid by the family because of the second earner entering workforce divided by the increase in family gross income because of the second earner entering in the workforce.

The **tax wedge**, the difference between the total labor cost of employing a worker and its net earnings, is calculated by expressing the sum of personal income tax, employee plus employer social security contributions together with any payroll tax, minus benefits as a percentage of labor costs.

The **average tax wedge** measures the part of total labor costs which is taken in tax and social security contributions net of cash benefits. The **marginal tax wedge** is the percentage of the marginal increase in labor costs that is deducted through the combined effect of increasing taxes and social security contributions and decreasing cash benefits.

The **marginal effective tax rate** measures what part of an increase in earnings, due to an increase in the number of hours worked or to a change in employment situation, is "taxed away" by the imposition of personal income taxes and employee social security contributions, considering the possible withdrawal of social and other earnings-related benefits.

The **net cost of childcare** is the difference in "family net income" of a family who uses center-based childcare and an otherwise identical family who does not as a percentage of net family income before deducting any childcare expenses.

The **net replacement rate** is the net income of an unemployed person receiving unemployment and possibly other benefits, expressed as a share of the income earned previously in the job before becoming unemployed and is calculated at different points in time because unemployment benefits

[1] http://www.oecd.org/els/benefits-and-wages.htm - http://www.oecd.org/tax/tax-policy/taxing-wages-20725124.htm - https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/tax-and-benefits-indicators-database_en

decline over unemployment spell. Similarly, the **net pension replacement rate** is defined as the individual net pension entitlement divided by net pre-retirement earnings, considering personal income taxes and social security contributions paid by workers and pensioners.

The **average effective age** of retirement is defined as the average age of exit from the labor force during a 5-year period calculated as a weighted average of (net) withdrawals from the labor market, net labor force exits being estimated by the difference in the participation rate for each 5-year age group (40 and over) at the beginning of the period and the rate for the corresponding age group aged 5-years older at the end of the period.

The **participation tax rate**, the proportion of gross earnings taken in tax or reduced benefits, is measured by one minus the financial gains to working (net income in work – net income out of work) as proportion of gross earnings, and is calculated for moving form inactivity (or unemployment benefits) to work.

The **trap,** calculated as the share of additional gross income of such a transition that is taxed away by the combined effects of higher taxes and lower benefits, refers to the financial incentive to move from one labor market situation to another. Hence, the **inactivity (unemployment) trap** measures the incentive for an inactive person (an unemployed person) not entitled to unemployment benefits but potentially receiving other benefits such as social assistance (receiving unemployment benefits) to move to paid employment. The **low-wage trap** measures the financial incentive to increase a low level of earnings by working additional hours.

Both these measures attempt to capture the incentive to work at all, or to progress in work and are defined for different income levels, and family situations. Low numbers correspond to stronger financial incentives, but are different and behave differently following different sorts of changes in income. For example, an increase in the gross hourly wage will strengthen incentives according to the net replacement rate, but will have ambiguous effects according to the participation tax rate. Moreover, as tax and benefits vary greatly across countries, international comparisons should be made cautiously and based on a broad range of measures.

Annex II. Estimation Results

Table 1. Dependent Variable: Unemployment Rate

	15-64	15-24	25-54	55-64	Lower Secondary	Upper Secondary	Tertiary Education	Men	Women
PTRUB	0.221***	0.446***	0.191**	0.151**	0.227**	0.224**	0.069	0.246***	0.180**
	(0.076)	(0.146)	(0.070)	(0.059)	(0.106)	(0.084)	(0.046)	(0.080)	(0.076)
Education (% Tertiary)	0.090	0.273	0.072	0.341	0.224	0.168	0.109	0.122	0.053
	(0.172)	(0.318)	(0.155)	(0.212)	(0.232)	(0.211)	(0.098)	(0.192)	(0.155)
GDP Growth	-0.279**	-0.528**	-0.273**	-0.143**	-0.353**	-0.296**	-0.181**	-0.319***	-0.233**
	(0.100)	(0.207)	(0.100)	(0.066)	(0.150)	(0.110)	(0.072)	(0.108)	(0.092)
Observations	300	300	300	283	300	299	294	300	300
R-squared	0.324	0.391	0.328	0.300	0.364	0.330	0.355	0.365	0.259
Number of countries	21	21	21	21	21	21	21	21	21
Average Tax Wedge	0.327*	0.726**	0.298**	0.304**	0.247	0.356*	0.113	0.404**	0.221
	(0.163)	(0.340)	(0.144)	(0.143)	(0.264)	(0.175)	(0.072)	(0.169)	(0.158)
Education (% Tertiary)	0.030	0.056	0.018	0.249	0.139	0.116	0.080	0.049	0.012
	(0.184)	(0.355)	(0.166)	(0.189)	(0.229)	(0.216)	(0.093)	(0.203)	(0.167)
GDP Growth	-0.300***	-0.571***	-0.287***	-0.172***	-0.330**	-0.320***	-0.182**	-0.354***	-0.233**
	(0.087)	(0.171)	(0.089)	(0.056)	(0.135)	(0.089)	(0.066)	(0.088)	(0.084)
Observations	432	432	432	412	432	430	423	432	432
R-squared	0.258	0.316	0.266	0.261	0.306	0.282	0.328	0.305	0.192
Number of countries	26	26	26	26	26	26	26	26	26
NRR5Y	0.264***	0.556***	0.230***	0.203***	0.338**	0.300***	0.120***	0.312***	0.208***
	(0.082)	(0.175)	(0.068)	(0.070)	(0.125)	(0.094)	(0.043)	(0.096)	(0.069)
Education (% Tertiary)	-0.030	-0.008	-0.038	0.209	0.089	0.045	0.038	-0.020	-0.041
	(0.174)	(0.334)	(0.155)	(0.188)	(0.238)	(0.202)	(0.087)	(0.189)	(0.160)
GDP Growth	-0.293***	-0.586***	-0.284***	-0.165**	-0.393***	-0.313***	-0.182***	-0.342***	-0.238***
	(0.090)	(0.188)	(0.089)	(0.062)	(0.125)	(0.097)	(0.062)	(0.098)	(0.081)
Observations	429	429	429	411	429	428	423	429	429
R-squared	0.345	0.404	0.352	0.332	0.405	0.365	0.402	0.388	0.276
Number of countries	33	33	33	33	33	33	33	33	33

Source: IMF Staff Calculation.
Notes: Standard errors are in parentheses.
* denotes significant at the 10 percent level, ** at 5 percent, *** at 1 percent.

PTRUB (respectively NRR5Y) is the participation tax rate from (repectively net replacement rate of) unemployment benefits averaged across all levels of income and family situations.

Table 2. Dependent Variable: Participation Rate

	15-64	15-24	25-54	55-64	Lower Secondary	Upper Secondary	Tertiary Education	Men	Women
PTR Inactivity	0.029	0.059	0.061	-0.363***	-0.030	0.067	0.103	0.012	0.153***
	(0.041)	(0.132)	(0.050)	(0.086)	(0.070)	(0.052)	(0.087)	(0.088)	(0.043)
Education (% Tertiary)	0.145	-0.067	0.205**	0.123	-0.266**	-0.157**	-0.071	-0.062	0.192
	(0.094)	(0.130)	(0.072)	(0.269)	(0.113)	(0.072)	(0.132)	(0.128)	(0.126)
GDP Growth	-0.043	-0.072	-0.024	0.036	-0.073	-0.050	0.051	0.026	-0.056
	(0.038)	(0.144)	(0.026)	(0.084)	(0.082)	(0.048)	(0.047)	(0.043)	(0.048)
Observations	300	300	300	300	300	300	300	300	300
R-squared	0.358	0.416	0.404	0.723	0.159	0.082	0.140	0.089	0.588
Number of countries	21	21	21	21	21	21	21	21	21
Average Tax Wedge	-0.108	-0.216	-0.095	-0.729***	-0.055	0.080	-0.075	-0.181**	0.022
	(0.100)	(0.246)	(0.101)	(0.230)	(0.169)	(0.125)	(0.088)	(0.087)	(0.153)
Education (% Tertiary)	0.130	0.031	0.197**	1.060***	-0.226*	-0.146*	-0.033	-0.024	0.195
	(0.100)	(0.136)	(0.082)	(0.121)	(0.120)	(0.078)	(0.116)	(0.108)	(0.140)
GDP Growth	-0.081**	-0.102	-0.033	-0.025	-0.119	-0.084*	-0.008	0.005	-0.110**
	(0.037)	(0.118)	(0.031)	(0.055)	(0.075)	(0.045)	(0.033)	(0.032)	(0.049)
Observations	432	432	432	432	432	432	432	432	432
R-squared	0.466	0.273	0.408	0.622	0.125	0.082	0.035	0.068	0.585
Number of countries	26	26	26	26	26	26	26	26	26

Source: IMF Staff Calculation.
Notes: Standard errors are in parentheses.
* Denotes significant at the 10 percent level, ** at 5 percent, *** at 1 percent.

PTR Inactivity is the participation tax rate from inactivity averaged across all levels of income and family situations.

Annex III. Introducing Interaction Terms

Table 1. Dependent Variable: Unemployment Rate

	15-64	15-24	25-54	55-64	Lower Secondary	Upper Secondary	Tertiary Education	Men	Women
PTR Unemployment Benefits (PTRUB)	0.222***	0.439***	0.193**	0.151**	0.234**	0.226**	0.071	0.251***	0.176**
	(0.076)	(0.144)	(0.070)	(0.059)	(0.108)	(0.085)	(0.048)	(0.081)	(0.075)
PTRUB#LUX	-0.026	0.300	-0.069	0.555	-0.297	-0.075	-0.082	-0.185	0.179
	(0.301)	(0.557)	(0.272)	(0.442)	(0.388)	(0.374)	(0.156)	(0.334)	(0.271)
Education (% Tertiary)	0.093	0.242	0.079	0.341	0.255	0.176	0.118	0.141	0.034
	(0.201)	(0.377)	(0.180)	(0.212)	(0.263)	(0.247)	(0.108)	(0.221)	(0.182)
GDP Growth	-0.279**	-0.530**	-0.273**	-0.143**	-0.351**	-0.295**	-0.181**	-0.318***	-0.234**
	(0.101)	(0.210)	(0.101)	(0.066)	(0.150)	(0.111)	(0.072)	(0.109)	(0.094)
Observations	300	300	300	283	300	299	294	300	300
R-squared	0.324	0.392	0.328	0.300	0.365	0.331	0.356	0.365	0.260
Number of countries	21	21	21	21	21	21	21	21	21
Average Tax Wedge (ATW)	0.345**	0.757**	0.318**	0.304**	0.265	0.385**	0.145*	0.426**	0.236
	(0.162)	(0.353)	(0.144)	(0.145)	(0.277)	(0.174)	(0.073)	(0.170)	(0.155)
ATW#LUX	-0.303	-0.529	-0.341	-0.024	-0.293	-0.438	-0.473**	-0.367	-0.238
	(0.420)	(0.869)	(0.381)	(0.201)	(0.611)	(0.500)	(0.227)	(0.461)	(0.380)
Education (% Tertiary)	0.059	0.106	0.050	0.249	0.166	0.158	0.127	0.084	0.034
	(0.213)	(0.413)	(0.191)	(0.190)	(0.266)	(0.250)	(0.096)	(0.233)	(0.197)
GDP Growth	-0.297***	-0.566***	-0.284***	-0.172***	-0.327**	-0.316***	-0.178***	-0.350***	-0.231**
	(0.087)	(0.171)	(0.089)	(0.056)	(0.135)	(0.089)	(0.063)	(0.088)	(0.084)
Observations	432	432	432	412	432	430	423	432	432
R-squared	0.259	0.317	0.268	0.261	0.307	0.285	0.337	0.307	0.193
Number of countries	26	26	26	26	26	26	26	26	26
Net Replacement Rate	0.265***	0.558***	0.232***	0.203***	0.343***	0.302***	0.122***	0.314***	0.209***
	(0.081)	(0.173)	(0.068)	(0.070)	(0.124)	(0.093)	(0.042)	(0.095)	(0.068)
NRR5Y#LUX	-0.529	-0.772	-0.542	-0.210	-1.882	-1.017	-0.825	-0.923	-0.092
	(1.305)	(2.404)	(1.168)	(1.203)	(1.692)	(1.521)	(0.507)	(1.414)	(1.195)
Education (% Tertiary)	0.012	0.053	0.004	0.210	0.237	0.125	0.103	0.053	-0.034
	(0.269)	(0.508)	(0.239)	(0.191)	(0.337)	(0.307)	(0.104)	(0.288)	(0.249)
GDP Growth	-0.291***	-0.583***	-0.282***	-0.165**	-0.385***	-0.309***	-0.178***	-0.339***	-0.238***
	(0.091)	(0.192)	(0.090)	(0.062)	(0.126)	(0.099)	(0.061)	(0.099)	(0.083)
Observations	429	429	429	411	429	428	423	429	429
R-squared	0.346	0.404	0.353	0.332	0.409	0.368	0.409	0.390	0.276
Number of countries	33	33	33	33	33	33	33	33	33

Source: IMF Staff Calculation.
Notes: Standard errors are in parentheses.
* Denotes significant at the 10 percent level, ** at 5 percent, *** at 1 percent.

PTRUB (respectively NRR5Y) is the participation tax rate from (repectively net replacement rate of) unemployment benefits averaged across all levels of income and family situations.

Table 2. Dependent Variable: Participation Rate

	15-64	15-24	25-54	55-64	Lower Secondary	Upper Secondary	Tertiary Education	Men	Women
PTR Inactivity (PTRIn)	0.024	0.047	0.055	-0.376***	-0.035	0.066	0.091	0.002	0.143***
	(0.042)	(0.135)	(0.051)	(0.086)	(0.070)	(0.054)	(0.089)	(0.090)	(0.040)
PTRIn#LUX	0.285	0.687*	0.333**	0.811	0.279	0.056	0.691***	0.616***	0.598***
	(0.172)	(0.397)	(0.154)	(0.542)	(0.337)	(0.281)	(0.182)	(0.196)	(0.189)
Education (% Tertiary)	0.096	-0.186	0.147*	-0.017	-0.314*	-0.167	-0.191*	-0.168	0.089
	(0.108)	(0.155)	(0.072)	(0.315)	(0.153)	(0.108)	(0.109)	(0.115)	(0.125)
GDP Growth	-0.047	-0.079	-0.028	0.027	-0.076	-0.051	0.044	0.020	-0.063
	(0.037)	(0.143)	(0.026)	(0.077)	(0.083)	(0.049)	(0.043)	(0.040)	(0.045)
Observations	300	300	300	300	300	300	300	300	300
R-squared	0.365	0.424	0.415	0.727	0.161	0.082	0.186	0.129	0.602
Number of countries	21	21	21	21	21	21	21	21	21
Average Tax Wedge (ATW)	-0.127	-0.266	-0.124	-0.668***	-0.060	0.086	-0.108	-0.206**	-0.016
	(0.105)	(0.273)	(0.102)	(0.240)	(0.184)	(0.140)	(0.088)	(0.090)	(0.156)
ATW#LUX	0.334	0.841	0.495***	-0.830*	0.092	-0.100	0.566**	0.424*	0.632**
	(0.218)	(0.575)	(0.161)	(0.474)	(0.396)	(0.304)	(0.227)	(0.208)	(0.279)
Education (% Tertiary)	0.098	-0.049	0.151**	1.091***	-0.235	-0.136	-0.087	-0.064	0.135
	(0.107)	(0.168)	(0.071)	(0.132)	(0.148)	(0.099)	(0.104)	(0.103)	(0.138)
GDP Growth	-0.084**	-0.109	-0.037	-0.020	-0.120	-0.083*	-0.013	0.001	-0.116**
	(0.036)	(0.117)	(0.032)	(0.054)	(0.076)	(0.046)	(0.032)	(0.031)	(0.049)
Observations	432	432	432	432	432	432	432	432	432
R-squared	0.470	0.281	0.420	0.625	0.125	0.082	0.054	0.079	0.592
Number of countries	26	26	26	26	26	26	26	26	26

Source: IMF Staff Calculation.

Notes: Standard errors are in parentheses.

* Denotes significant at the 10 percent level, ** at 5 percent, *** at 1 percent.

PTR Inactivity is the participation tax rate from inactivity averaged across all levels of income and family situations.

Annex IV. Excluding Luxembourg

Table 1. Dependent Variable: Unemployment Rate

	15-64	15-24	25-54	55-64	Lower Secondary	Upper Secondary	Tertiary Education	Men	Women
PTRUB	0.221***	0.435***	0.192**	0.151**	0.233**	0.225**	0.071	0.250***	0.175**
	(0.076)	(0.144)	(0.070)	(0.059)	(0.107)	(0.084)	(0.046)	(0.080)	(0.075)
Education (% Tertiary)	0.149	0.366	0.139	0.347	0.361	0.289	0.233	0.219	0.072
	(0.343)	(0.642)	(0.306)	(0.222)	(0.442)	(0.410)	(0.135)	(0.375)	(0.312)
GDP Growth	-0.277**	-0.525**	-0.271**	-0.144**	-0.346**	-0.287**	-0.174**	-0.316**	-0.231**
	(0.109)	(0.223)	(0.107)	(0.068)	(0.161)	(0.119)	(0.071)	(0.118)	(0.100)
Observations	285	285	285	277	285	284	279	285	285
R-squared	0.326	0.392	0.330	0.302	0.365	0.337	0.370	0.371	0.258
Number of countries	20	20	20	20	20	20	20	20	20
Average Tax Wedge	0.344**	0.748**	0.317**	0.302**	0.267	0.385**	0.146*	0.427**	0.230
	(0.162)	(0.351)	(0.144)	(0.145)	(0.278)	(0.174)	(0.074)	(0.171)	(0.154)
Education (% Tertiary)	0.082	0.091	0.073	0.253	0.225	0.213	0.159	0.132	0.028
	(0.268)	(0.521)	(0.239)	(0.195)	(0.328)	(0.312)	(0.111)	(0.288)	(0.248)
GDP Growth	-0.296***	-0.567***	-0.284***	-0.172***	-0.325**	-0.311***	-0.177**	-0.350***	-0.228**
	(0.091)	(0.179)	(0.093)	(0.056)	(0.141)	(0.093)	(0.065)	(0.093)	(0.088)
Observations	415	415	415	405	415	413	407	415	415
R-squared	0.260	0.317	0.270	0.262	0.305	0.288	0.339	0.310	0.195
Number of countries	25	25	25	25	25	25	25	25	25
NRR5Y	0.262***	0.552***	0.229***	0.203***	0.338**	0.297***	0.120***	0.310***	0.205***
	(0.081)	(0.174)	(0.068)	(0.070)	(0.124)	(0.092)	(0.041)	(0.095)	(0.068)
Education (% Tertiary)	0.022	0.052	0.013	0.213	0.254	0.150	0.128	0.061	-0.020
	(0.297)	(0.561)	(0.263)	(0.195)	(0.373)	(0.339)	(0.112)	(0.318)	(0.274)
GDP Growth	-0.293***	-0.586***	-0.284***	-0.166**	-0.388***	-0.309***	-0.180***	-0.342***	-0.237***
	(0.094)	(0.197)	(0.093)	(0.063)	(0.130)	(0.101)	(0.062)	(0.102)	(0.084)
Observations	414	414	414	405	414	413	408	414	414
R-squared	0.348	0.406	0.354	0.333	0.408	0.371	0.411	0.393	0.278
Number of countries	32	32	32	32	32	32	32	32	32

Source: IMF Staff Calculation.

Notes: Standard errors are in parentheses.

* Denotes significant at the 10 percent level, ** at 5 percent, *** at 1 percent.

PTRUB (respectively NRR5Y) is the participation tax rate from (repectively net replacement rate of) unemployment benefits averaged across all levels of income and family situations.

Table 2. Dependent Variable: Participation Rate

	15-64	15-24	25-54	55-64	Lower Secondary	Upper Secondary	Tertiary Education	Men	Women
PTR Inactivity	0.024	0.050	0.054	-0.374***	-0.037	0.067	0.091	0.005	0.141***
	(0.040)	(0.135)	(0.050)	(0.086)	(0.069)	(0.053)	(0.088)	(0.089)	(0.039)
Education (% Tertiary)	0.063	-0.185	0.118	-0.131	-0.320*	-0.185	-0.261**	-0.238*	0.047
	(0.120)	(0.187)	(0.078)	(0.356)	(0.182)	(0.127)	(0.109)	(0.119)	(0.138)
GDP Growth	-0.051	-0.070	-0.033	0.016	-0.072	-0.055	0.038	0.014	-0.067
	(0.036)	(0.145)	(0.026)	(0.075)	(0.086)	(0.049)	(0.042)	(0.040)	(0.044)
Observations	285	285	285	285	285	285	285	285	285
R-squared	0.302	0.425	0.310	0.719	0.141	0.079	0.202	0.154	0.535
Number of countries	20	20	20	20	20	20	20	20	20
Average Tax Wedge	-0.130	-0.268	-0.128	-0.655**	-0.055	0.084	-0.121	-0.215**	-0.025
	(0.106)	(0.274)	(0.102)	(0.242)	(0.187)	(0.143)	(0.089)	(0.092)	(0.155)
Education (% Tertiary)	0.058	-0.013	0.104	1.111***	-0.205	-0.166	-0.187**	-0.156*	0.068
	(0.122)	(0.212)	(0.071)	(0.141)	(0.182)	(0.119)	(0.077)	(0.082)	(0.152)
GDP Growth	-0.088**	-0.099	-0.040	-0.022	-0.119	-0.083*	-0.015	0.000	-0.119**
	(0.036)	(0.121)	(0.033)	(0.056)	(0.080)	(0.047)	(0.033)	(0.033)	(0.050)
Observations	415	415	415	415	415	415	415	415	415
R-squared	0.445	0.276	0.367	0.615	0.103	0.082	0.080	0.110	0.559
Number of countries	25	25	25	25	25	25	25	25	25

Source: IMF Staff Calculation.
Notes: Standard errors are in parentheses.
* Denotes significant at the 10 percent level, ** at 5 percent, *** at 1 percent.
PTR Inactivity is the participation tax rate from inactivity averaged across all levels of income and family situations.