

# Datos

Test

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# 1 Data Analysis

## 1.1 Data Reported in Sistema de Información Infonavit: 2013/01-2021/04

Information regarding all mortgages originated by Infonavit from January 2013 to April 2021.

[https://portalmx.infonavit.org.mx/wps/portal/infonavit.web/el-instituto/el-infonavit/SII/!ut/p/z1/pZBBDolwFETP4gn-FJHWJRosFQKiqUA3pitCoujCeH7RJcSKcXY\\_eTN\\_MmSolItPZR9vYe3vt7Lm\\_axOcAgnEa59lQh05iijwc873yAWncgCkyQIFdonEFuzAQOYfv\\_am-T0ByBVYJkUsEG4iFS3TuSc1m-bHB4U\\_9x8Bxh1fkhm8GC\\_oBF4TvQHXBt9a3C66V4VWNbMnVfmrRQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/](https://portalmx.infonavit.org.mx/wps/portal/infonavit.web/el-instituto/el-infonavit/SII/!ut/p/z1/pZBBDolwFETP4gn-FJHWJRosFQKiqUA3pitCoujCeH7RJcSKcXY_eTN_MmSolItPZR9vYe3vt7Lm_axOcAgnEa59lQh05iijwc873yAWncgCkyQIFdonEFuzAQOYfv_am-T0ByBVYJkUsEG4iFS3TuSc1m-bHB4U_9x8Bxh1fkhm8GC_oBF4TvQHXBt9a3C66V4VWNbMnVfmrRQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/)

```
# Número de Créditos Formalizados
NCTotal<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 1))
MCTipoProducto<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 2))
NCLinea<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 3))
NCClasificacionVivienda<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 4))
NCIngreso<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 5))
NCEdad<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 6))
NCEstado<-as.data.frame(read_excel("DATA/NumeroDeCreditosFormalizados.xlsx", sheet = 7))

## Totales
NC_TP<-as.data.frame(read_excel("DATA/Totales/NC.xlsx",sheet=1))
NC_L<-as.data.frame(read_excel("DATA/Totales/NC.xlsx",sheet=2))
NC_CV<-as.data.frame(read_excel("DATA/Totales/NC.xlsx",sheet=3))
NC_I<-as.data.frame(read_excel("DATA/Totales/NC.xlsx",sheet=4))
NC_Edad<-as.data.frame(read_excel("DATA/Totales/NC.xlsx",sheet=5))
NC_Estado<-as.data.frame(read_excel("DATA/Totales/NC.xlsx",sheet=6))

# Importe de Cheque
ITotal<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 1))
ITipoProducto<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 2))
ILinea<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 3))
IClasificacionVivienda<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 4))
IIngreso<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 5))
IEdad<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 6))
IEstado<-as.data.frame(read_excel("DATA/ImporteDeCheque.xlsx", sheet = 7))

## Totales
I_TP<-as.data.frame(read_excel("DATA/Totales/I.xlsx",sheet=1))
I_L<-as.data.frame(read_excel("DATA/Totales/I.xlsx",sheet=2))
I_CV<-as.data.frame(read_excel("DATA/Totales/I.xlsx",sheet=3))
I_I<-as.data.frame(read_excel("DATA/Totales/I.xlsx",sheet=4))
I_Edad<-as.data.frame(read_excel("DATA/Totales/I.xlsx",sheet=5))
I_Estado<-as.data.frame(read_excel("DATA/Totales/I.xlsx",sheet=6))

# Monto de Crédito Infonavit
MCTotal<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 1))
MCTipoProducto<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 2))
MCLinea<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 3))
MCClasificacionVivienda<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 4))
MCIngreso<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 5))
MCEdad<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 6))
MCEstado<-as.data.frame(read_excel("DATA/MontoDeCreditoInfonavit.xlsx", sheet = 7))

## Totales
```

```

MC_TP<-as.data.frame(read_excel("DATA/Totales/MC.xlsx",sheet=1))
MC_L<-as.data.frame(read_excel("DATA/Totales/MC.xlsx",sheet=2))
MC_CV<-as.data.frame(read_excel("DATA/Totales/MC.xlsx",sheet=3))
MC_I<-as.data.frame(read_excel("DATA/Totales/MC.xlsx",sheet=4))
MC_Edad<-as.data.frame(read_excel("DATA/Totales/MC.xlsx",sheet=5))
MC_Estado<-as.data.frame(read_excel("DATA/Totales/MC.xlsx",sheet=6))

# Número de Subsidios
NSTotal<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 1))
NSTipoProducto<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 2))
NSLinea<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 3))
NSClasificacionVivienda<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 4))
NSIngreso<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 5))
NSEdad<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 6))
NSEstado<-as.data.frame(read_excel("DATA/NumeroDeSubsidios.xlsx", sheet = 7))
## Totales
NS_TP<-as.data.frame(read_excel("DATA/Totales/NS.xlsx",sheet=1))
NS_L<-as.data.frame(read_excel("DATA/Totales/NS.xlsx",sheet=2))
NS_CV<-as.data.frame(read_excel("DATA/Totales/NS.xlsx",sheet=3))
NS_I<-as.data.frame(read_excel("DATA/Totales/NS.xlsx",sheet=4))
NS_Edad<-as.data.frame(read_excel("DATA/Totales/NS.xlsx",sheet=5))
NS_Estado<-as.data.frame(read_excel("DATA/Totales/NS.xlsx",sheet=6))

# Monto de Subsidios
MSTotal<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 1))
MSTipoProducto<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 2))
MSLinea<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 3))
MSClasificacionVivienda<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 4))
MSIngreso<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 5))
MSEdad<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 6))
MSEstado<-as.data.frame(read_excel("DATA/MontoDeSubsidios.xlsx", sheet = 7))
## Totales
MS_TP<-as.data.frame(read_excel("DATA/Totales/MS.xlsx",sheet=1))
MS_L<-as.data.frame(read_excel("DATA/Totales/MS.xlsx",sheet=2))
MS_CV<-as.data.frame(read_excel("DATA/Totales/MS.xlsx",sheet=3))
MS_I<-as.data.frame(read_excel("DATA/Totales/MS.xlsx",sheet=4))
MS_Edad<-as.data.frame(read_excel("DATA/Totales/MS.xlsx",sheet=5))
MS_Estado<-as.data.frame(read_excel("DATA/Totales/MS.xlsx",sheet=6))

# Recaudación y Fiscalización de las Aportaciones Patronales
RFAP<-as.data.frame(read_excel("DATA/RecaudacionYFiscalizacionDeAportacionesPatronales.xlsx", sheet = 1))

# Administración de la Subcuenta de Vivienda
ASV<-as.data.frame(read_excel("DATA/AdminSubcuentaDeVivienda.xlsx", sheet = 1))

```

### 1.1.1 Number of Credits Granted

```

# Por Estado
barplot_NC_Estado<-ggplot(data=NC_Estado)+
  geom_bar(aes(x=reorder(Estado,-NC),y=NC,fill=Estado),stat = "identity")+

```

```

geom_text(aes(x=Estado,y=NC,label=NC),hjust=-0.2, size=2.5,angle=90)+
scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
labs( x = "State",
      y = "Number of loans granted",
      title = "Loan distribution per State",
      subtitle = "2013/01 - 2021/04"
    )+
ylim(0,625000)+
theme(
  axis.text.x=element_text(size=8,angle=45,hjust=1),
  axis.text.y=element_text(size=0,angle=45),
  plot.title = element_text(hjust=0.5),
  plot.subtitle=element_text(hjust=0.5),
  legend.position = "none"
)

# Por Estado como porcentaje
percent_Estado<-paste(round(100*(NC_Estado$NC/(sum(NC_Estado$NC))), 2), "%", sep="")
NC_Estado$percent<-percent_Estado

barplot_NC_Estado_percent<-ggplot(data=NC_Estado)+
  geom_bar(aes(x=reorder(Estado,-NC),y=NC,fill=Estado),stat = "identity")+
  geom_text(aes(x=Estado,y=NC,label=percent_Estado),hjust=-0.2, size=2.5,angle=90)+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
  labs( x = "State",
        y = "% / Total Loans Granted",
        title = "Loan distribution per State",
        subtitle = "2013/01 - 2021/04"
      )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=0,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )+ylim(0,625000)

# Por Tipo de Producto
percent_TP<-paste(round(100*(NC_TP$NC/(sum(NC_TP$NC))), 2), "%", sep="")
NC_TP$percent=percent_TP

piechart_NC_TP<-ggplot(data=NC_TP, aes(x="", y=NC, fill=TipoProducto)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_TP), size=3.5, show.legend = F, position = position_stack(vjust =
guides(fill = guide_legend(title = "Product Type"))+
scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
labs(
  y="",
  x="",
  title="Loan Distribution by Product Type",
  subtitle="2013/01 - 2021/04"

```

```

)+
theme(
  plot.title = element_text(hjust=0.5),
  plot.subtitle = element_text(hjust=0.5),
  axis.text = element_blank(),
  axis.ticks = element_blank(),
  panel.grid = element_blank()
)

# Por Clasificación de Vivienda
percent_CV<-paste(round(100*(NC_CV$NC/(sum(NC_CV$NC))), 2), "%", sep="")
NC_CV$percent=percent_CV

piechart_NC_CV<-ggplot(data=NC_CV, aes(x="", y=NC, fill=ClasificacionVivienda)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_CV), size=3.5, show.legend = F, position = position_stack(vjust =
  guides(fill = guide_legend(title = "Dwelling Classification"))+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
  labs(
    y="",
    x="",
    title="Loan Distribution by Dwelling Classification",
    subtitle="2013/01 - 2021/04"
  )+
  theme(
    plot.title = element_text(hjust=0.5),
    plot.subtitle = element_text(hjust=0.5),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    panel.grid = element_blank()
  )

# Por Linea
percent_L<-paste(round(100*(NC_L$NC/(sum(NC_L$NC))), 2), "%", sep="")
NC_L$percent=percent_L

piechart_NC_L<-ggplot(data=NC_L, aes(x="", y=NC, fill=Linea)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_L), size=3.5, show.legend = F, position = position_stack(vjust =
  guides(fill = guide_legend(title = "Credit Line"))+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
  labs(
    y="",
    x="",
    title="Loan Distribution by Credit Line",
    subtitle="2013/01 - 2021/04"
  )+
  theme(
    plot.title = element_text(hjust=0.5),
    plot.subtitle = element_text(hjust=0.5),
    axis.text = element_blank(),

```

```

    axis.ticks = element_blank(),
    panel.grid = element_blank()
)

# Por Ingreso
UMA<-c("1", "1-2", "2-3", "3-4", "4-5", "5-6", "6-7", "7-8", "8-9", "9-10", "10-11", "11-12", "12-13", "13-14", "14-15")
NC_I$UMA<-UMA

barplot_NC_I<-ggplot(data=NC_I)+
  geom_bar(aes(x=reorder(UMA,-NC),y=NC,fill=UMA),stat = "identity")+
  geom_text(aes(x=UMA,y=NC,label=NC),hjust=-0.2, size=2.5,angle=90)+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(NC_I)))+
  labs( x = "Income (UMA)",
        y = "Number of loans granted",
        title = "Loans distribution by Income (UMA)",
        subtitle = "2013/01 - 2021/04"
    )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=0,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )+
  coord_cartesian(ylim=c(0,1300000))

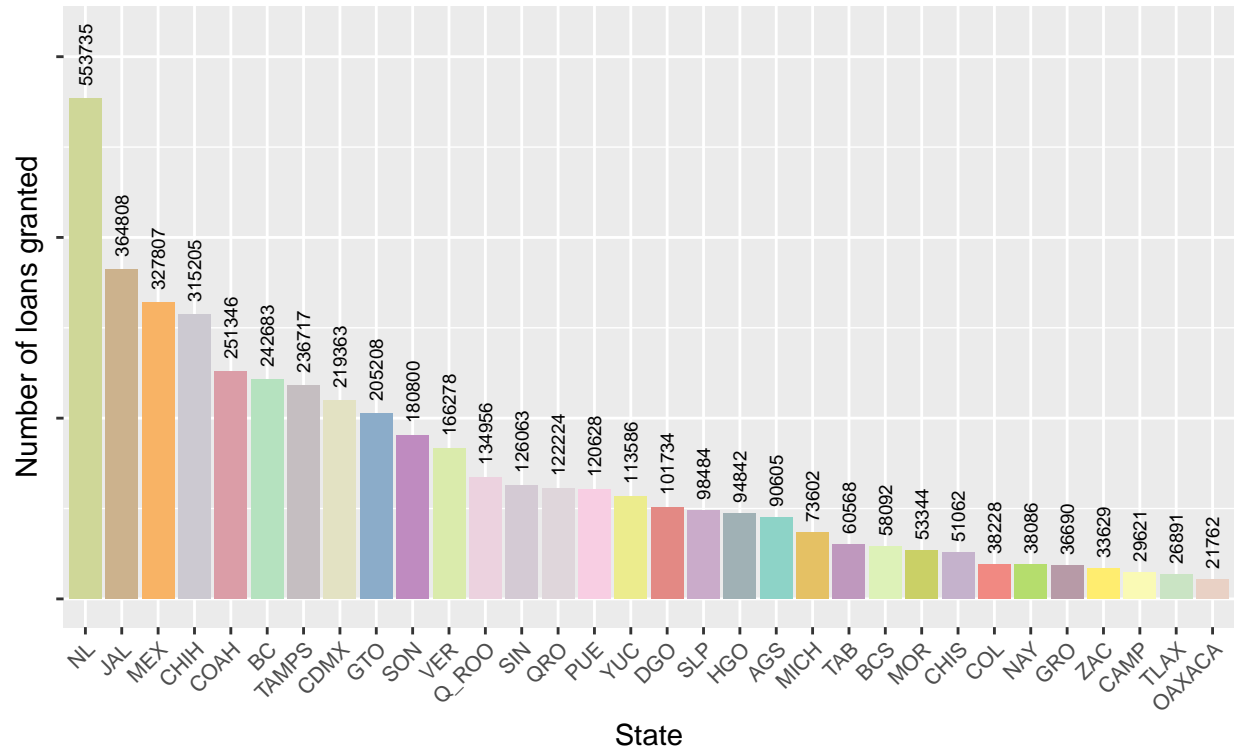
# Por Edad
Edad2<-c("20", "21-25", "26-30", "31-35", "36-40", "41-45", "46-50", "51-55", "56-60", "61-65", "65+", "Otros")
NC_Edad$Edad2<-Edad2

barplot_NC_Edad<-ggplot(data=NC_Edad)+
  geom_bar(aes(x=Edad2,y=NC,fill=Edad2),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(NC_I)))+
  labs( x = "Age group",
        y = "Number of loans granted",
        title = "Loan distribution by Age",
        subtitle = "2013/01 - 2021/04"
    )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=6,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

```

```
barplot_NC_Estado
```

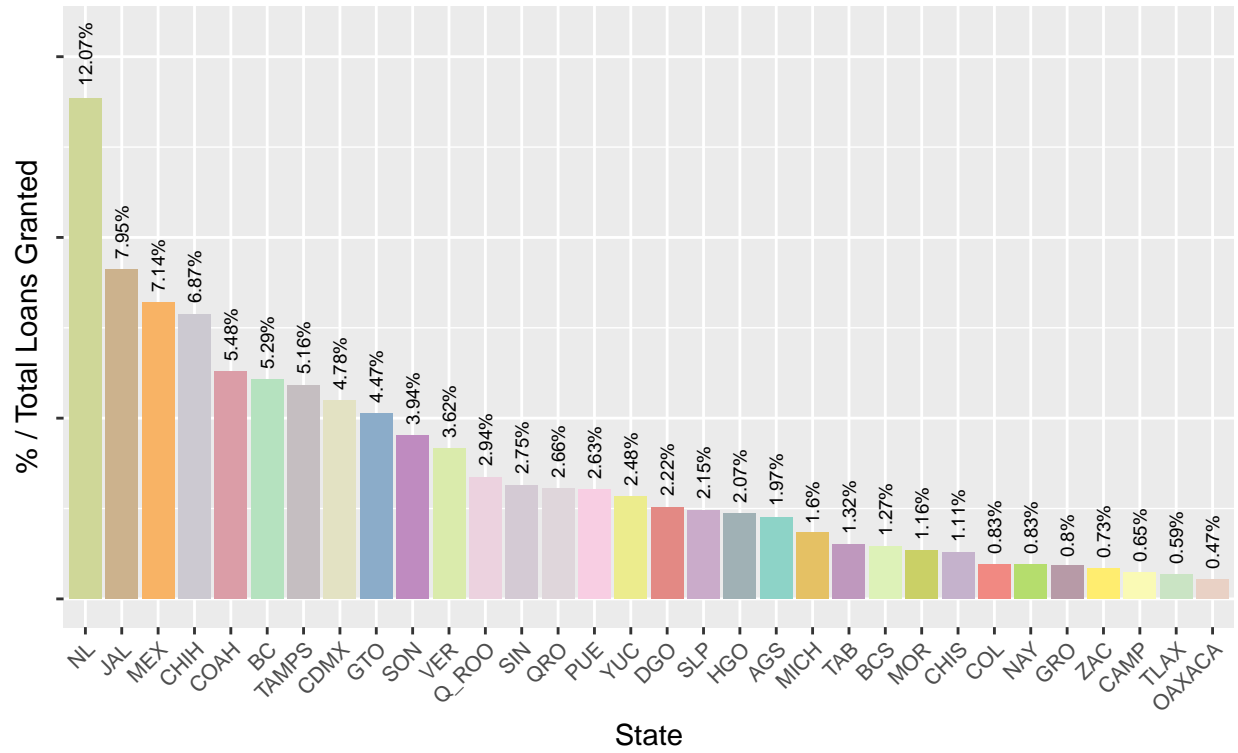
Loan distribution per State  
2013/01 – 2021/04



barplot\_NC\_Estado\_percent

## Loan distribution per State

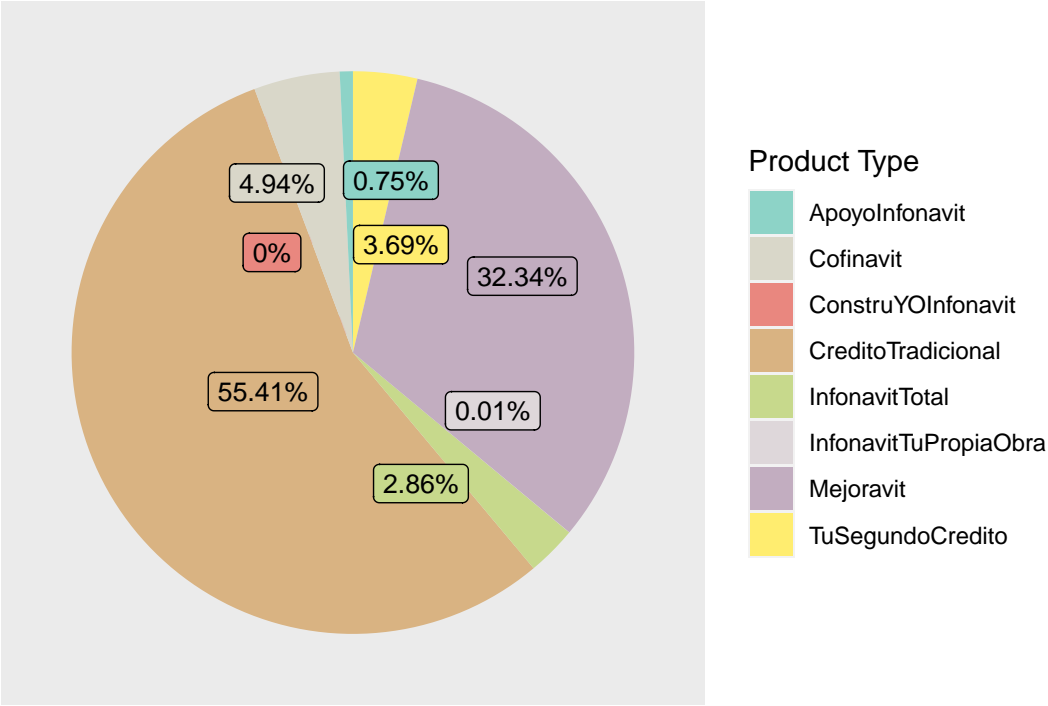
2013/01 – 2021/04



piechart\_NC\_TP

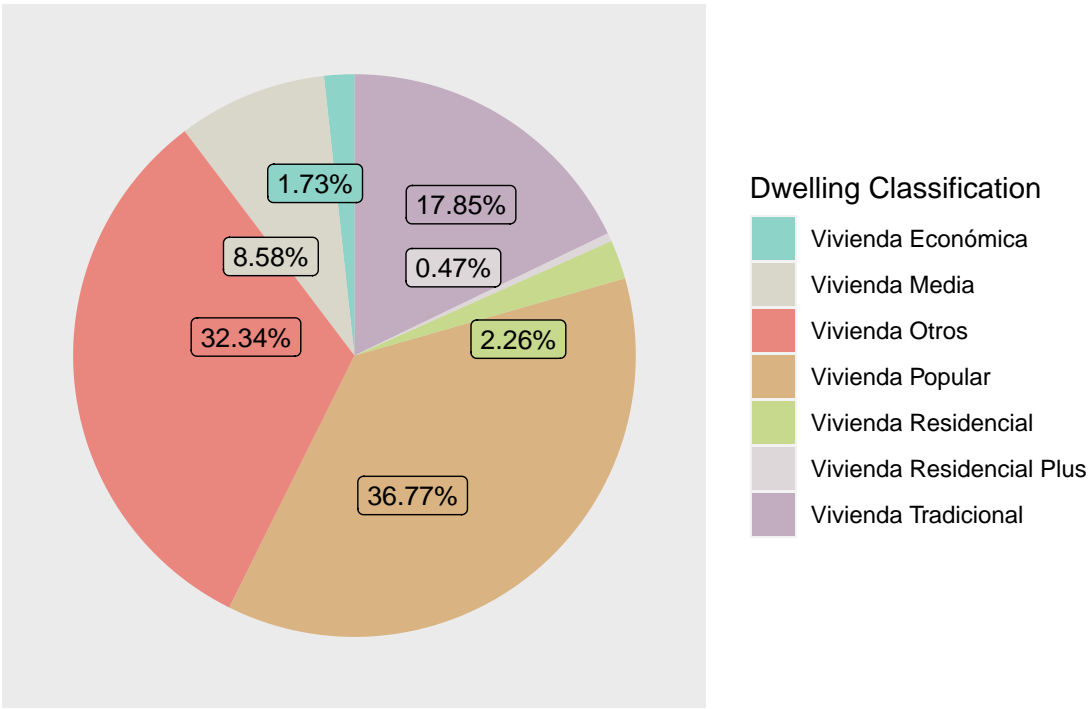


Loan Distribution by Product Type  
2013/01 – 2021/04



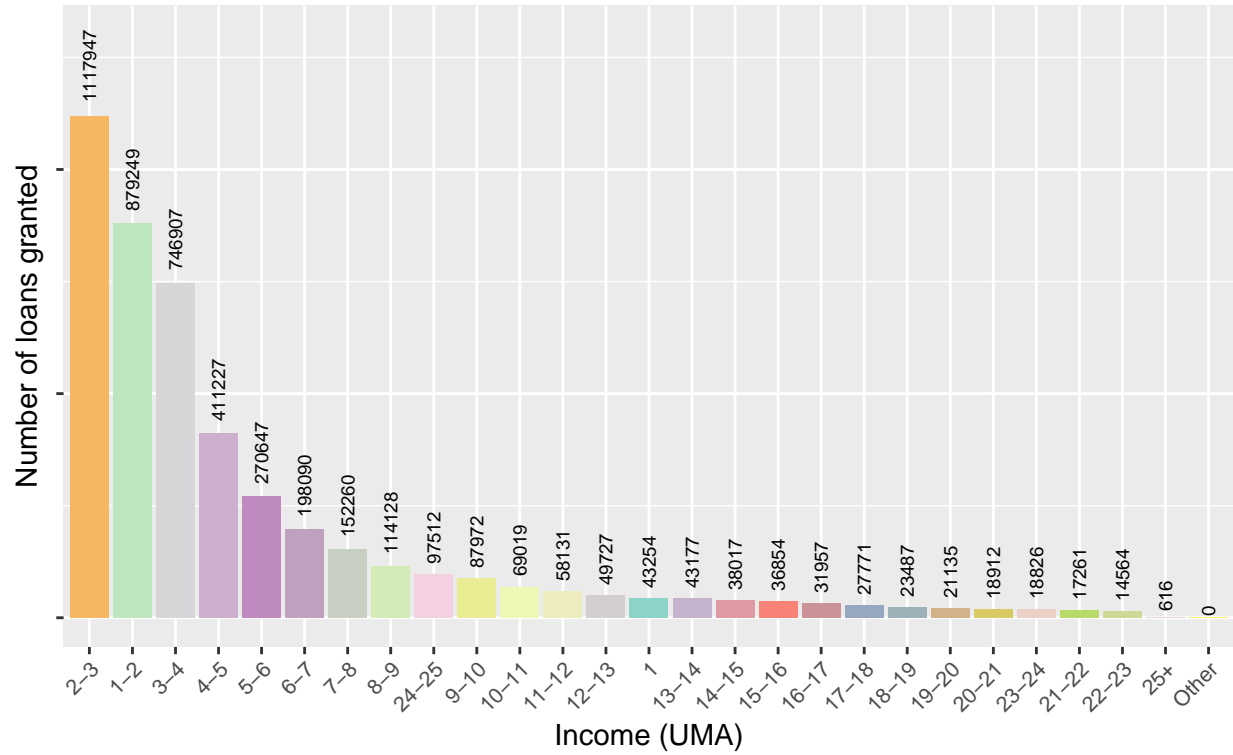
piechart\_NC\_CV

Loan Distribution by Dwelling Classification  
2013/01 – 2021/04



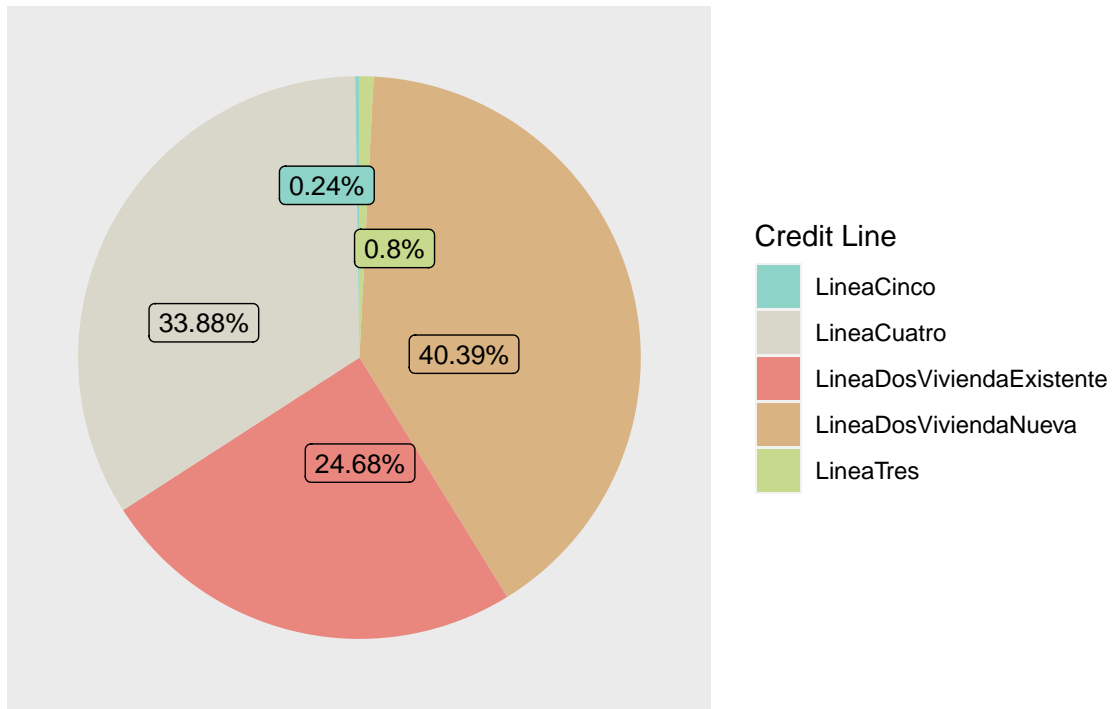
barplot\_NC\_I

Loans distribution by Income (UMA)  
2013/01 – 2021/04

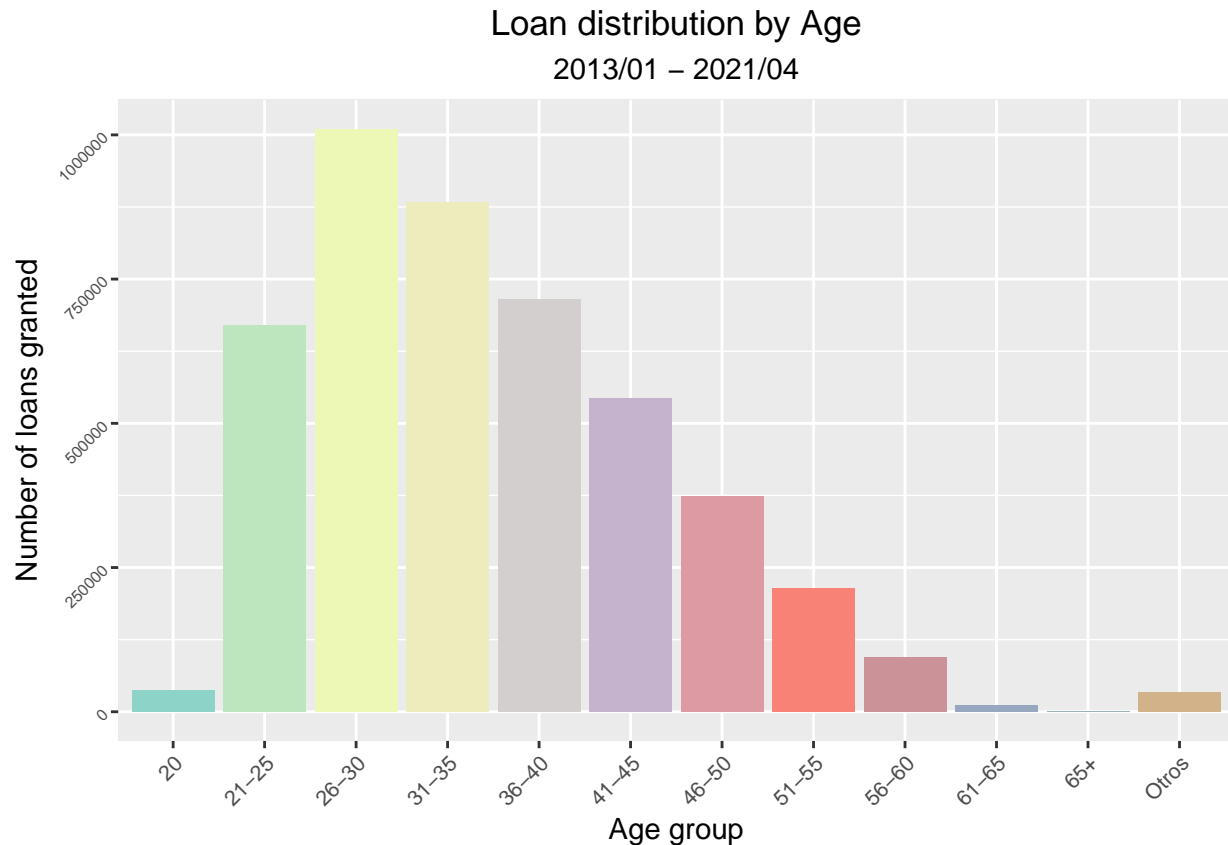


piechart\_NC\_L

Loan Distribution by Credit Line  
2013/01 – 2021/04



barplot\_NC\_Edad



#### 1.1.2 Credit Amount (MXN)

```
# Por Estado
barplot_MC_Estado<-ggplot(data=MC_Estado)+
  geom_bar(aes(x=reorder(Estado,-MC),y=MC,fill=Estado),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
  labs( x = "State",
        y = "Credit amount (MXN)",
        title = "Total Amount of Granted Credit by State",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=8,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

# Por Estado como porcentaje
percent_Estado2<-paste(round(100*(MC_Estado$MC/(sum(MC_Estado$MC))), 2), "%", sep="")
MC_Estado$percent<-percent_Estado2

barplot_MC_Estado_percent<-ggplot(data=MC_Estado)+
```

```

geom_bar(aes(x=reorder(Estado,-MC),y=MC,fill=Estado),stat = "identity")+
geom_text(aes(x=Estado,y=MC,label=percent_Estado2),hjust=-0.2, size=2.5,angle=90)+
scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
labs( x = "State",
      y = "% / Total Amount of Credit",
      title ="Total Amount of Granted Credit by State (%)",
      subtitle = "2013/01 - 2021/04"
    )+
theme(
  axis.text.x=element_text(size=8,angle=45,hjust=1),
  axis.text.y=element_text(size=0,angle=45),
  plot.title = element_text(hjust=0.5),
  plot.subtitle=element_text(hjust=0.5),
  legend.position = "none"
)+ylim(0,143000000000)

# Por Tipo de Producto
percent_TP2<-paste(round(100*(MC_TP$MC/(sum(MC_TP$MC))), 2), "%", sep="")
MC_TP$percent=percent_TP2

piechart_MC_TP<-ggplot(data=MC_TP, aes(x="", y=MC, fill=TipoProducto)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_TP2), size=3, show.legend = F, position = position_stack(vjust =
guides(fill = guide_legend(title = "Product Type"))+
scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
labs(
  y="",
  x="",
  title="Total Amount of Granted Credit by Product Type",
  subtitle="2013/01 - 2021/04"
)+
theme(
  plot.title = element_text(hjust=0.5),
  plot.subtitle = element_text(hjust=0.5),
  axis.text = element_blank(),
  axis.ticks = element_blank(),
  panel.grid = element_blank()
)

# Por Clasificación de Vivienda
percent_CV2<-paste(round(100*(MC_CV$MC/(sum(MC_CV$MC))), 2), "%", sep="")
MC_CV$percent=percent_CV2

piechart_MC_CV<-ggplot(data=MC_CV, aes(x="", y=MC, fill=ClasificacionVivienda)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_CV2), size=3.5, show.legend = F, position = position_stack(vjust =
guides(fill = guide_legend(title = "Dwelling Classification"))+
scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
labs(
  y="",
  x="",

```

```

    title="Total Amount of Granted Credit by Dwelling Classification",
    subtitle="2013/01 - 2021/04"
  )+
  theme(
    plot.title = element_text(hjust=0.5),
    plot.subtitle = element_text(hjust=0.5),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    panel.grid = element_blank()
  )

# Por Linea
percent_L2<-paste(round(100*(MC_L$MC/(sum(MC_L$MC))), 2), "%", sep="")
MC_L$percent=percent_L2

piechart_MC_L<-ggplot(data=MC_L, aes(x="", y=MC, fill=Linea)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_L2), size=3.5, show.legend = F, position = position_stack(vjust = 1)) +
  guides(fill = guide_legend(title = "Credit Line"))+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
  labs(
    y="",
    x="",
    title="Total Amount of Granted Credit by Credit Line",
    subtitle="2013/01 - 2021/04"
  )+
  theme(
    plot.title = element_text(hjust=0.5),
    plot.subtitle = element_text(hjust=0.5),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    panel.grid = element_blank()
  )

# Por Ingreso
MC_I$UMA<-UMA

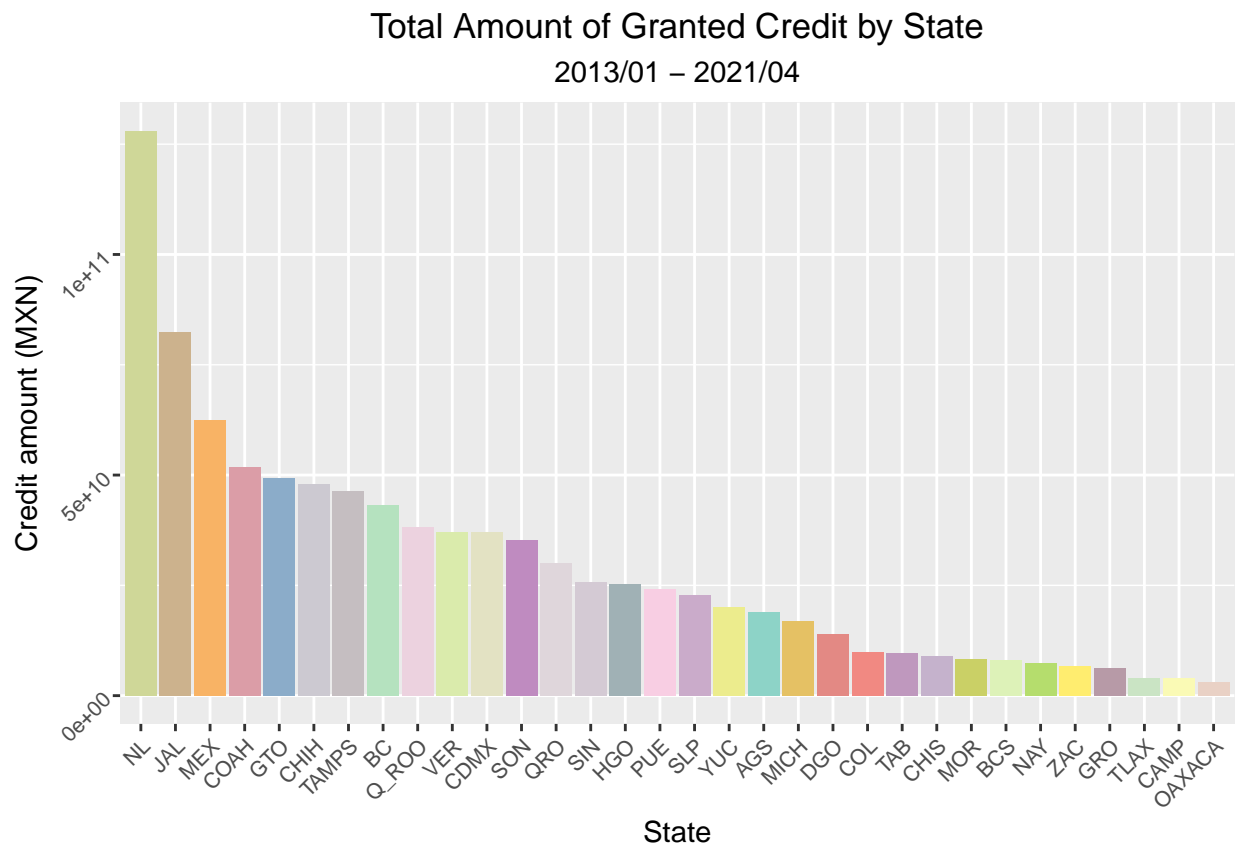
barplot_MC_I<-ggplot(data=MC_I)+
  geom_bar(aes(x=reorder(UMA,-MC),y=MC,fill=UMA),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(MC_I)))+
  labs( x = "Income (UMA)",
    y = "Credit Amount (MXN)",
    title = "Total Amount of Granted Credit by Income (UMA)",
    subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=8,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

```

```
# Por Edad
MC_Edad$Edad2<-Edad2

barplot_MC_Edad<-ggplot(data=MC_Edad)+
  geom_bar(aes(x=Edad2,y=MC,fill=Edad2),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(MC_I)))+
  labs( x = "Age group",
        y = "Credit Amount (MXN)",
        title = "Total Amount of Granted Credit by Age",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=6,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )
```

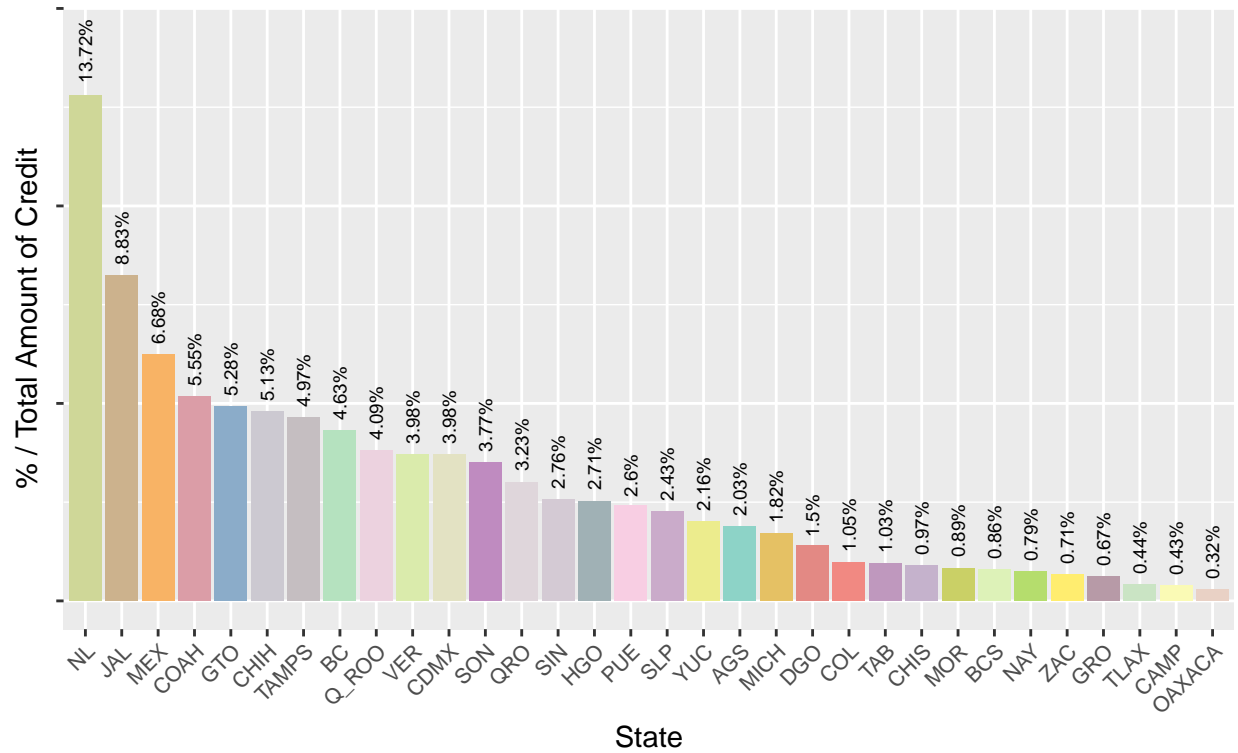
```
barplot_MC_Estado
```



```
barplot_MC_Estado_percent
```

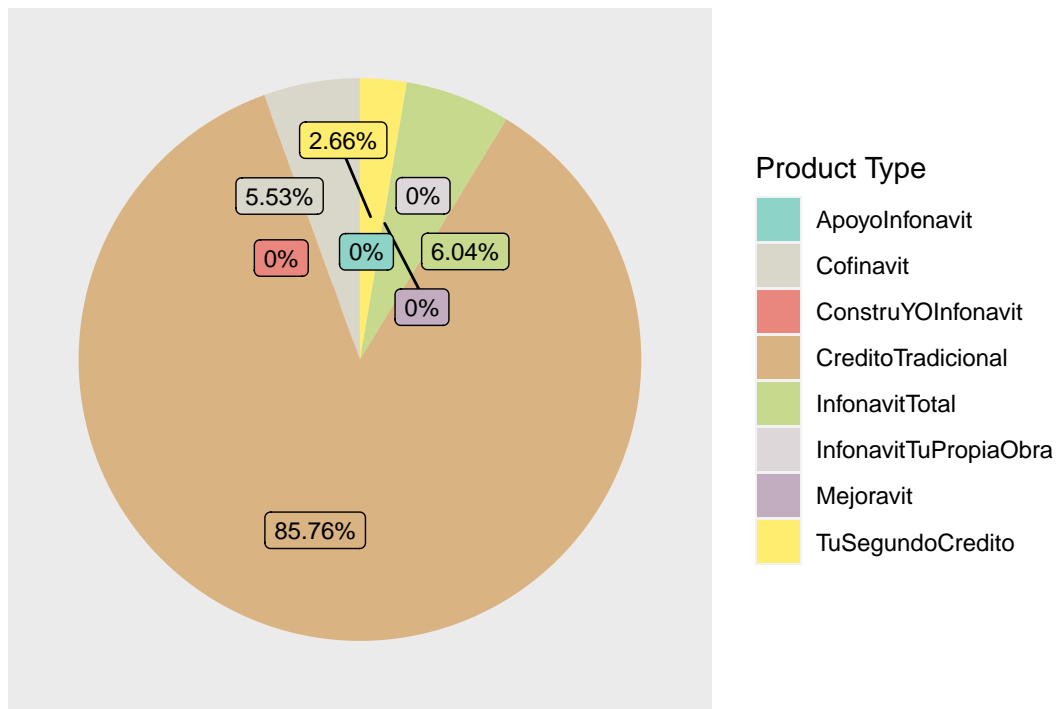


Total Amount of Granted Credit by State (%)  
2013/01 – 2021/04



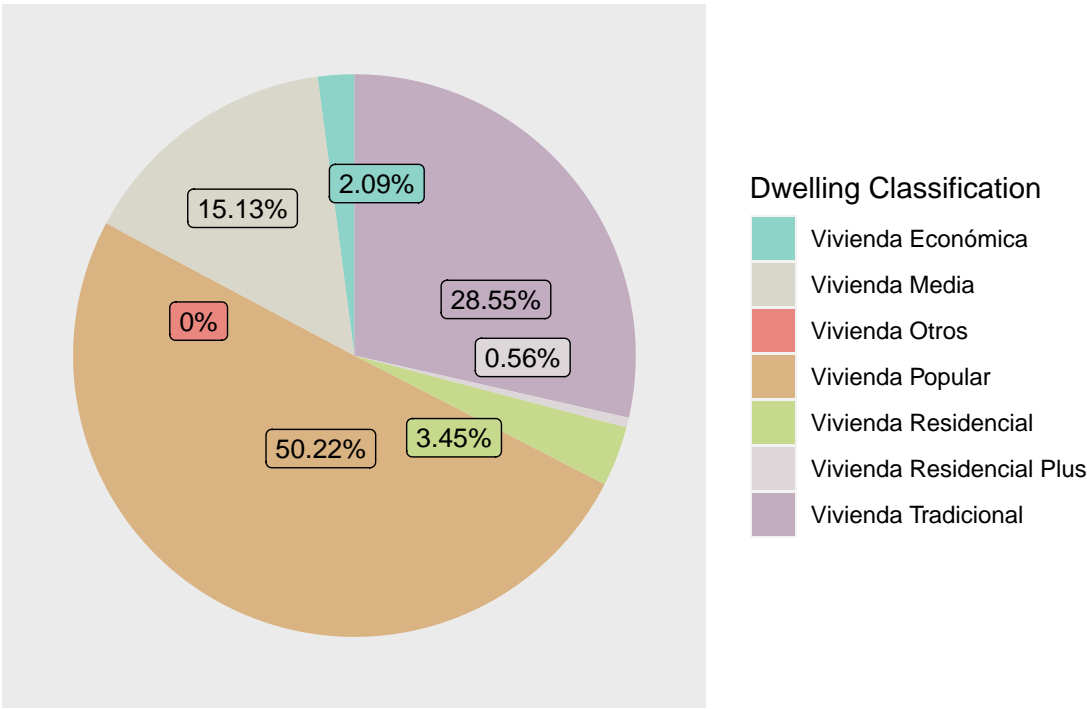
piechart\_MC\_TP

# Total Amount of Granted Credit by Product Type 2013/01 – 2021/04



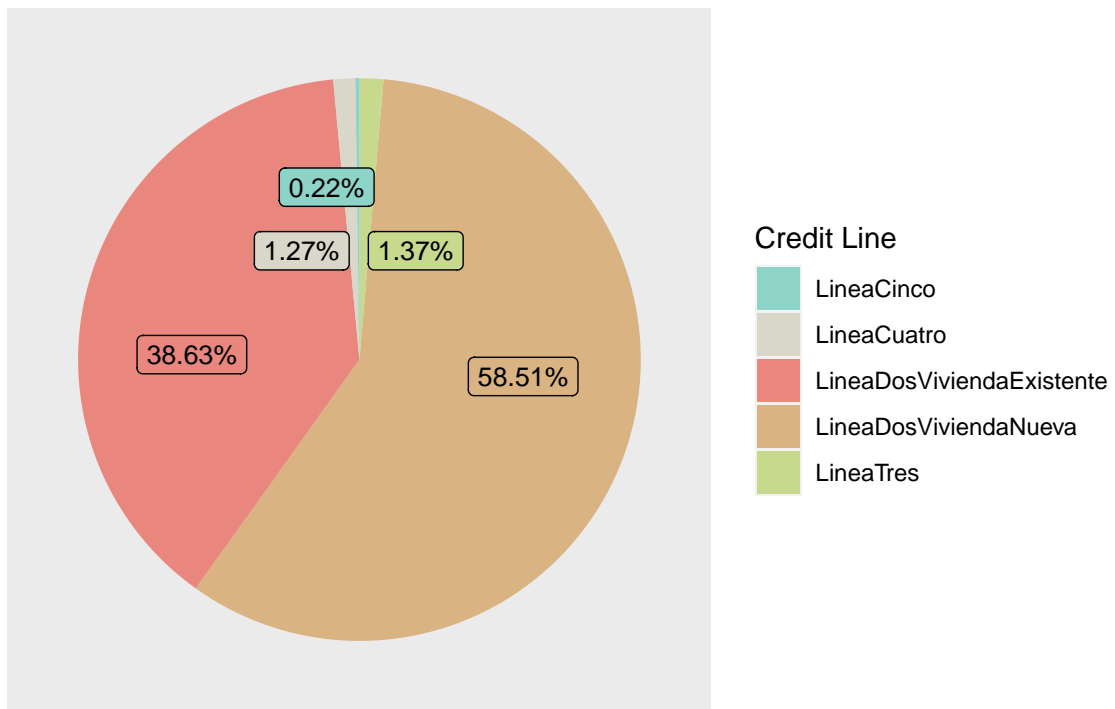
piechart\_MC\_CV

Total Amount of Granted Credit by Dwelling Classification  
2013/01 – 2021/04



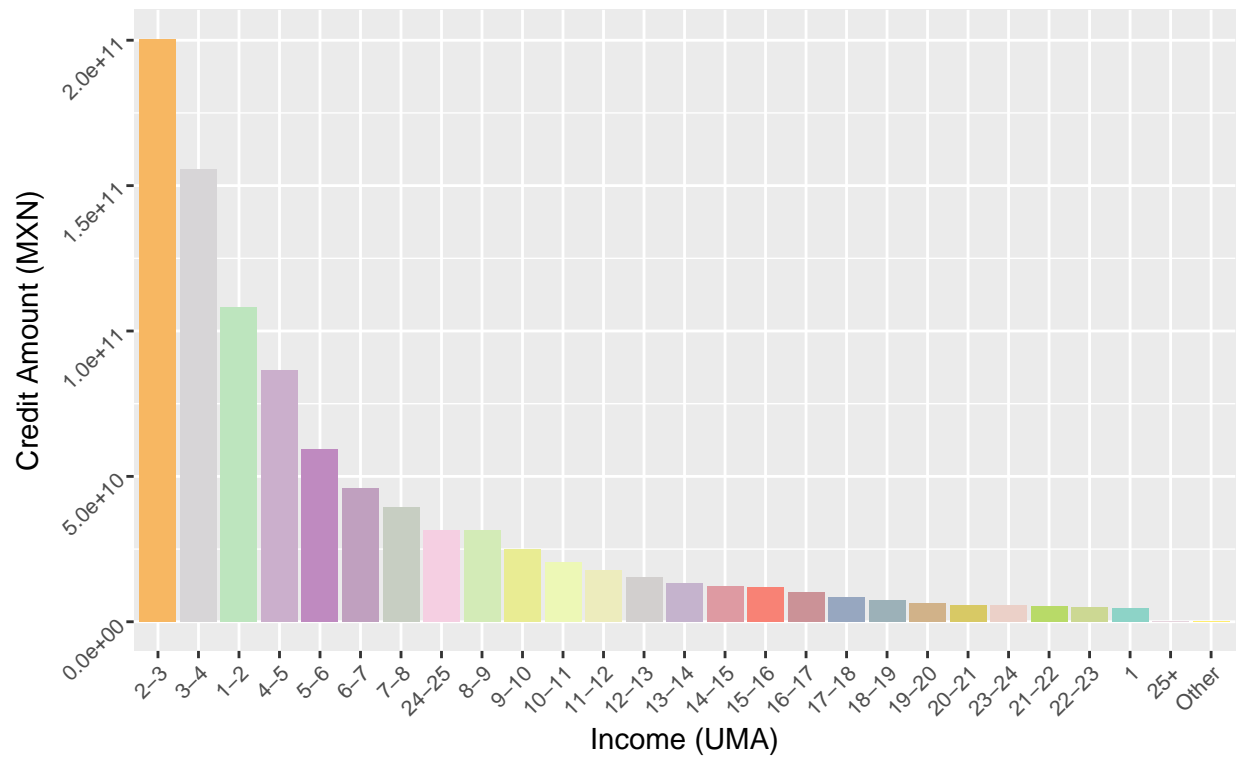
piechart\_MC\_L

Total Amount of Granted Credit by Credit Line  
2013/01 – 2021/04



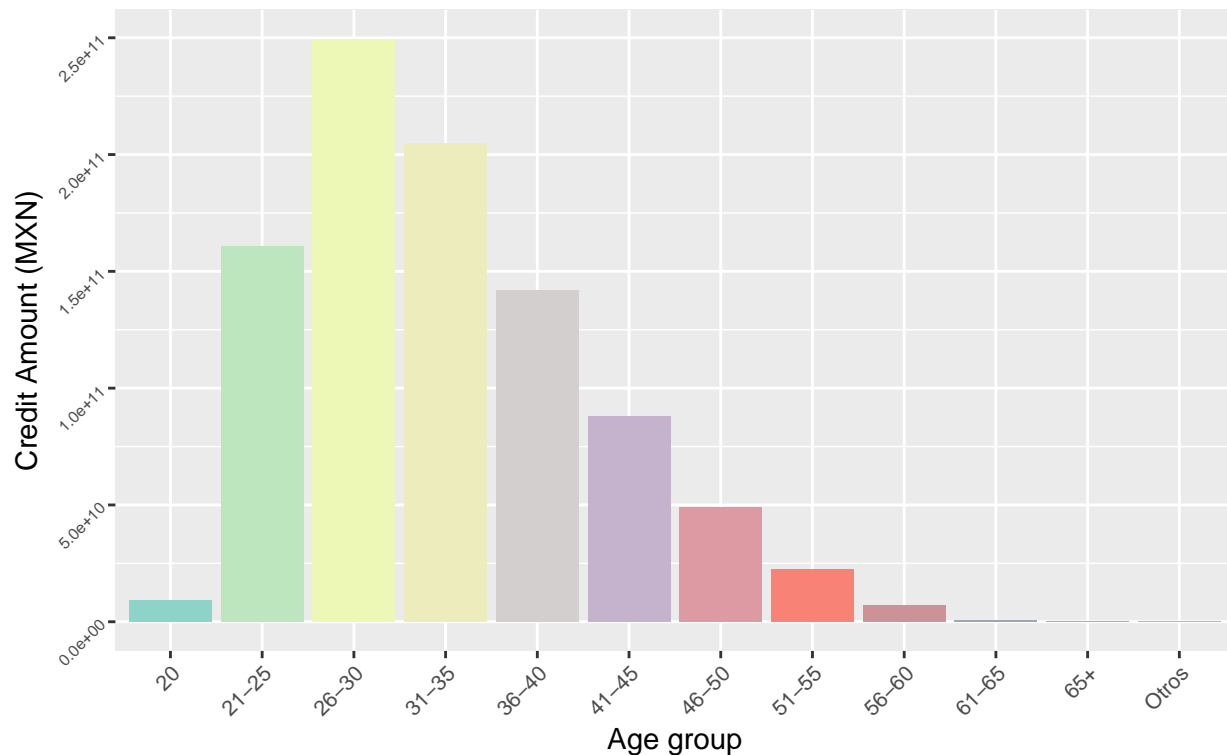
barplot\_MC\_I

Total Amount of Granted Credit by Income (UMA)  
2013/01 – 2021/04



barplot\_MC\_Edad

Total Amount of Granted Credit by Age  
2013/01 – 2021/04



### 1.1.3 Subsidies

```
# Por Estado
barplot_NS_Estado<-ggplot(data=NS_Estado)+
  geom_bar(aes(x=reorder(Estado,-NS),y=NS,fill=Estado),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
  labs( x = "State",
        y = "Number of Subsidies",
        title = "Number of Granted Subsidies by State",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=8,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

# Por Estado como porcentaje
percent_Estado3<-paste(round(100*(NS_Estado$NS/(sum(NS_Estado$NS))), 2), "%", sep="")
NS_Estado$percent<-percent_Estado3
```

```

barplot_NS_Estado_percent<-ggplot(data=NS_Estado)+
  geom_bar(aes(x=reorder(Estado,-NS),y=NS,fill=Estado),stat = "identity")+
  geom_text(aes(x=Estado,y=NS,label=percent_Estado3),hjust=-0.2, size=2.5,angle=90)+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
  labs( x = "State",
        y = "% / Total Subsidies Granted",
        title ="Number of Granted Subsidies by State (%)",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=0,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

# Por Tipo de Producto
# No Aplica: Todos son crédito tradicional

# Por Clasificación de Vivienda
percent_CV3<-paste(round(100*(NS_CV$NS/(sum(NS_CV$NS))), 2), "%", sep="")
NS_CV$percent=percent_CV3

piechart_NS_CV<-ggplot(data=NS_CV, aes(x="", y=NS, fill=ClasificacionVivienda)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_CV3), size=3.5, show.legend = F, position = position_stack(vjust = 1.5)) +
  guides(fill = guide_legend(title = "Dwelling Classification"))+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
  labs(
    y="",
    x="",
    title="Distribution of Subsidies by Dwelling Classification",
    subtitle="2013/01 - 2021/04"
  )+
  theme(
    plot.title = element_text(hjust=0.5),
    plot.subtitle = element_text(hjust=0.5),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    panel.grid = element_blank()
  )

# Por Linea
percent_L3<-paste(round(100*(NS_L$NS/(sum(NS_L$NS))), 2), "%", sep="")
NS_L$percent=percent_L3

piechart_NS_L<-ggplot(data=NS_L, aes(x="", y=NS, fill=Linea)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_L3), size=3.5, show.legend = F, position = position_stack(vjust = 1.5)) +
  guides(fill = guide_legend(title = "Credit Line"))+

```

```

scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
labs(
  y="",
  x="",
  title="Distribution of Subsidies by Credit Line",
  subtitle="2013/01 - 2021/04"
)+
theme(
  plot.title = element_text(hjust=0.5),
  plot.subtitle = element_text(hjust=0.5),
  axis.text = element_blank(),
  axis.ticks = element_blank(),
  panel.grid = element_blank()
)

# Por Ingreso
NS_I$UMA<-UMA

barplot_NS_I<-ggplot(data=NS_I)+
  geom_bar(aes(x=reorder(UMA,-NS),y=NS,fill=UMA),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(NS_I)))+
  labs( x = "Income (UMA)",
        y = "Number of Subsidies",
        title = "Number of Granted Subsidies by Income (UMA)",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=8,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

# Por Edad
NS_Edad$Edad2<-Edad2

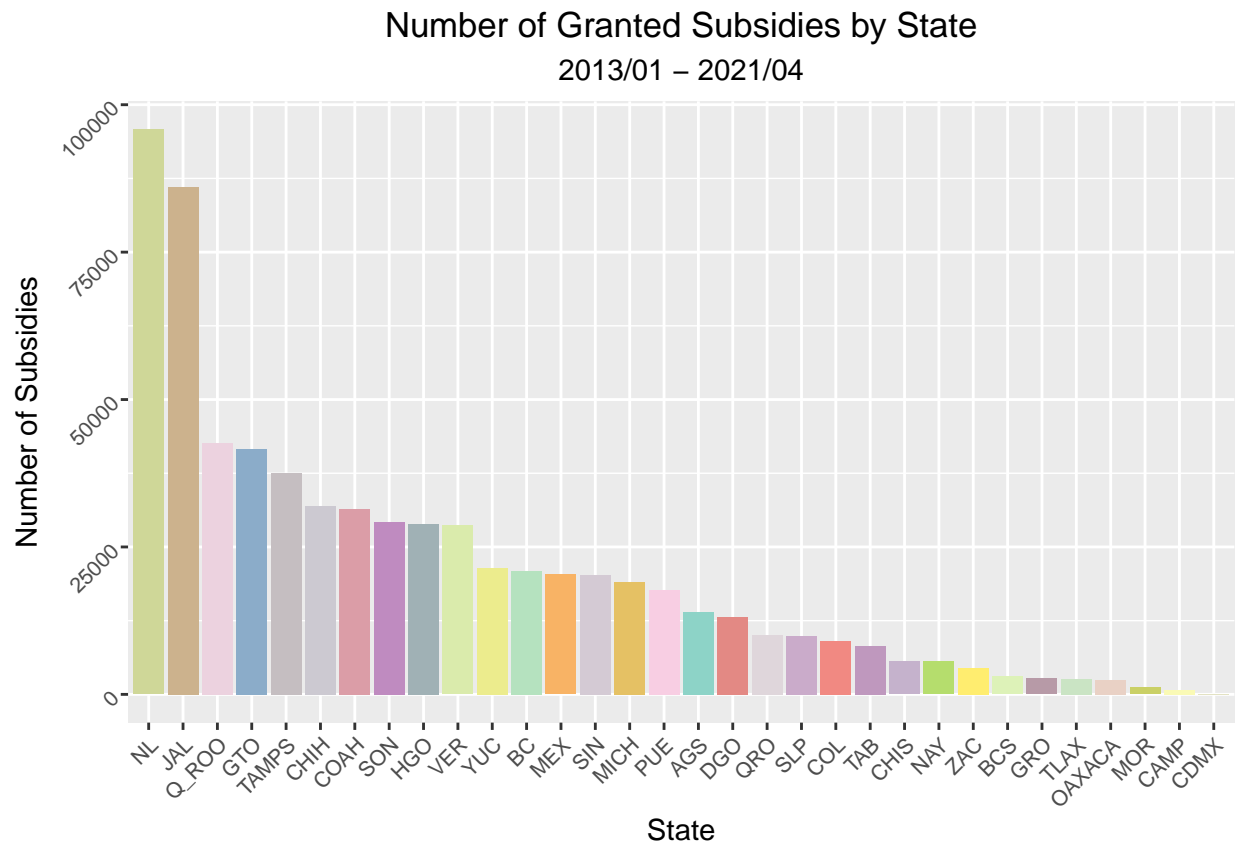
barplot_NS_Edad<-ggplot(data=NS_Edad)+
  geom_bar(aes(x=Edad2,y=NS,fill=Edad2),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(NS_I)))+
  labs( x = "Age group",
        y = "Number of Subsidies",
        title = "Number of Granted Subsidies by Age",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=6,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

```



barplot\_NS\_Estado

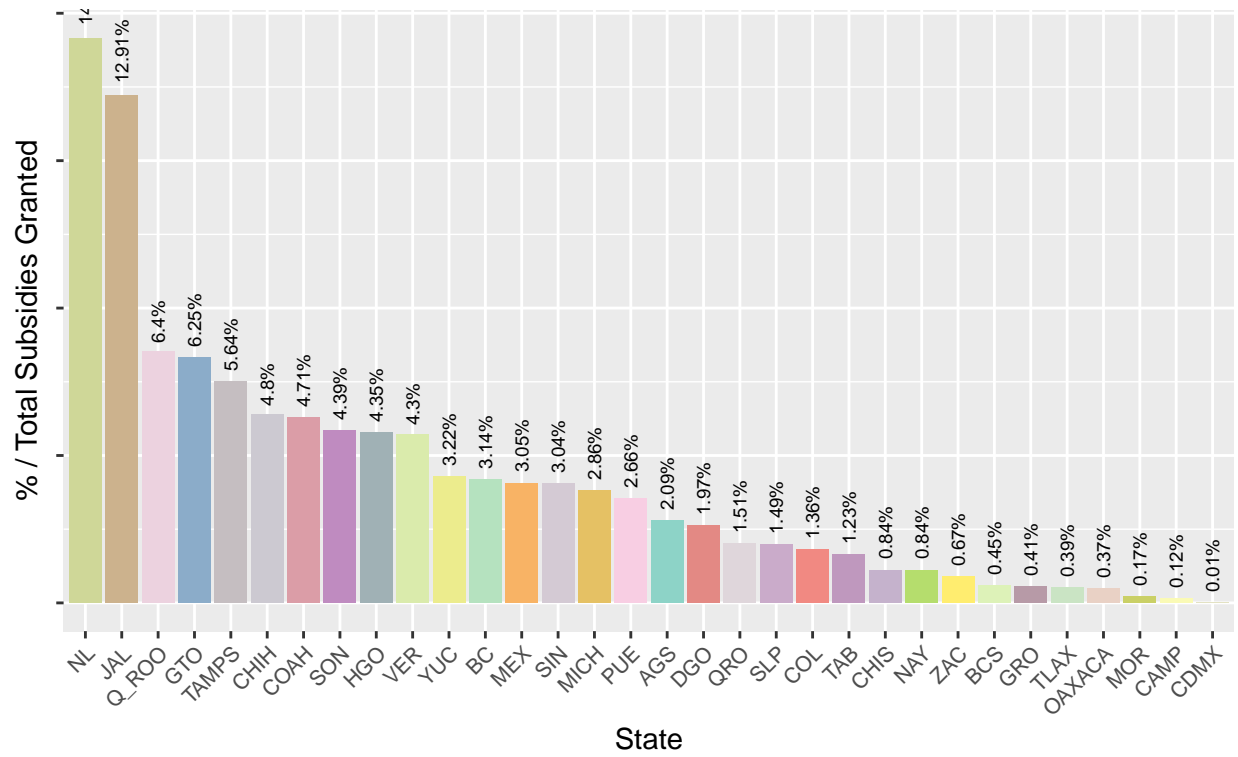
### 1.1.3.1 Number



barplot\_NS\_Estado\_percent

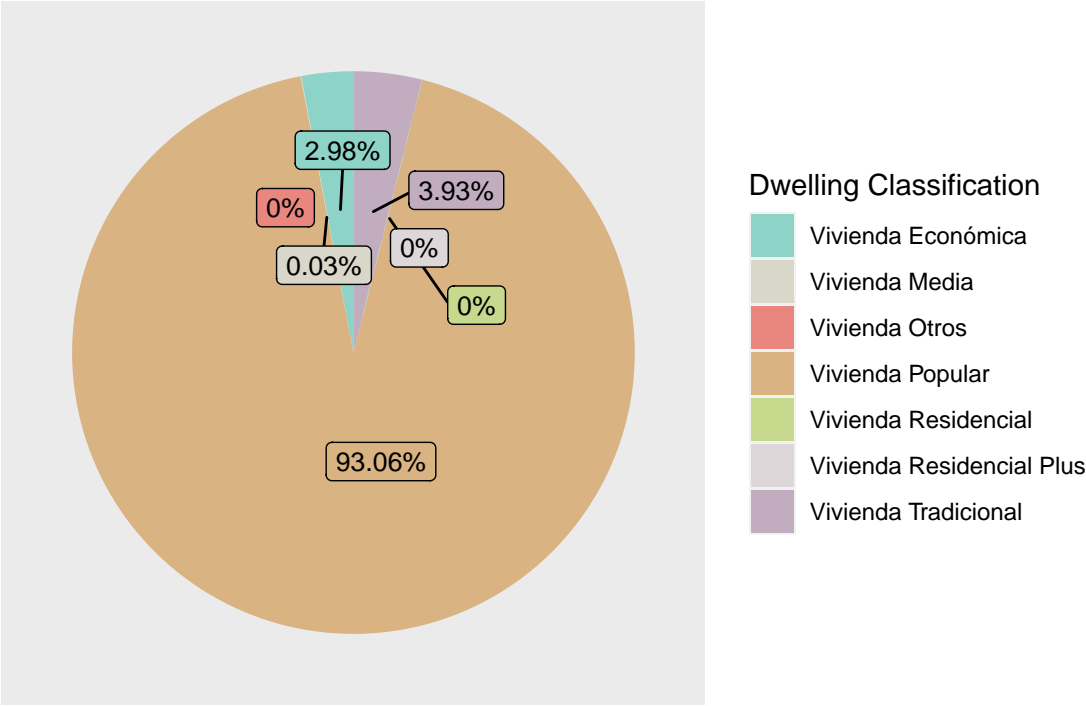
## Number of Granted Subsidies by State (%)

2013/01 – 2021/04



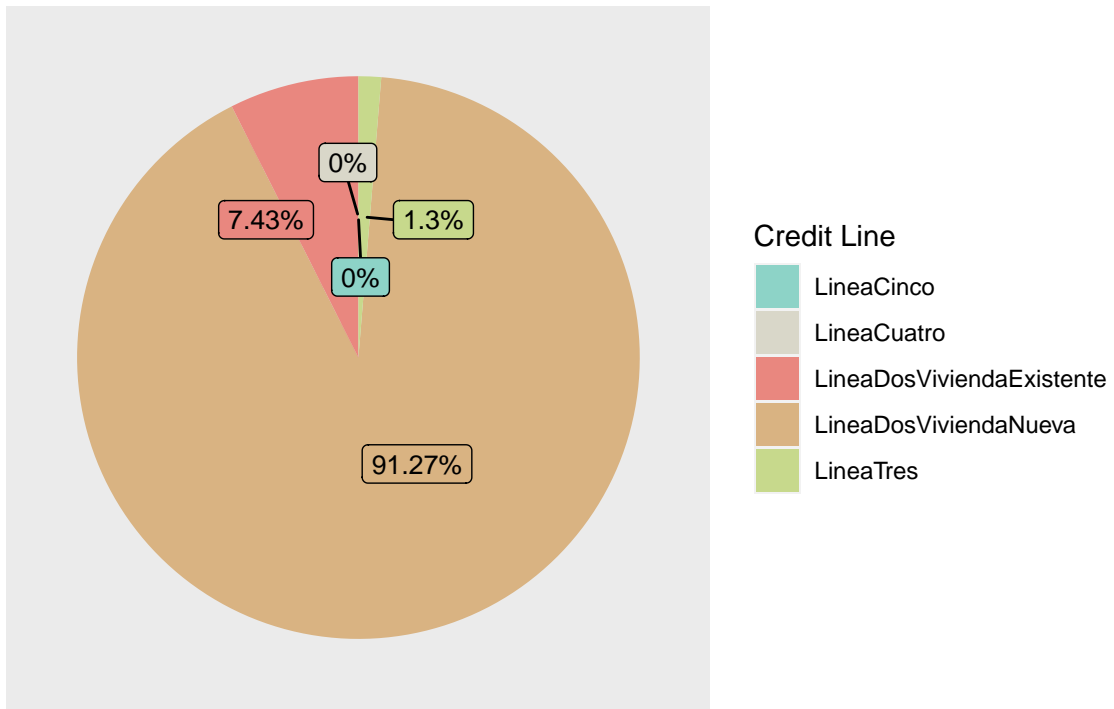
piechart\_NS\_CV

Distribution of Subsidies by Dwelling Classification  
2013/01 – 2021/04



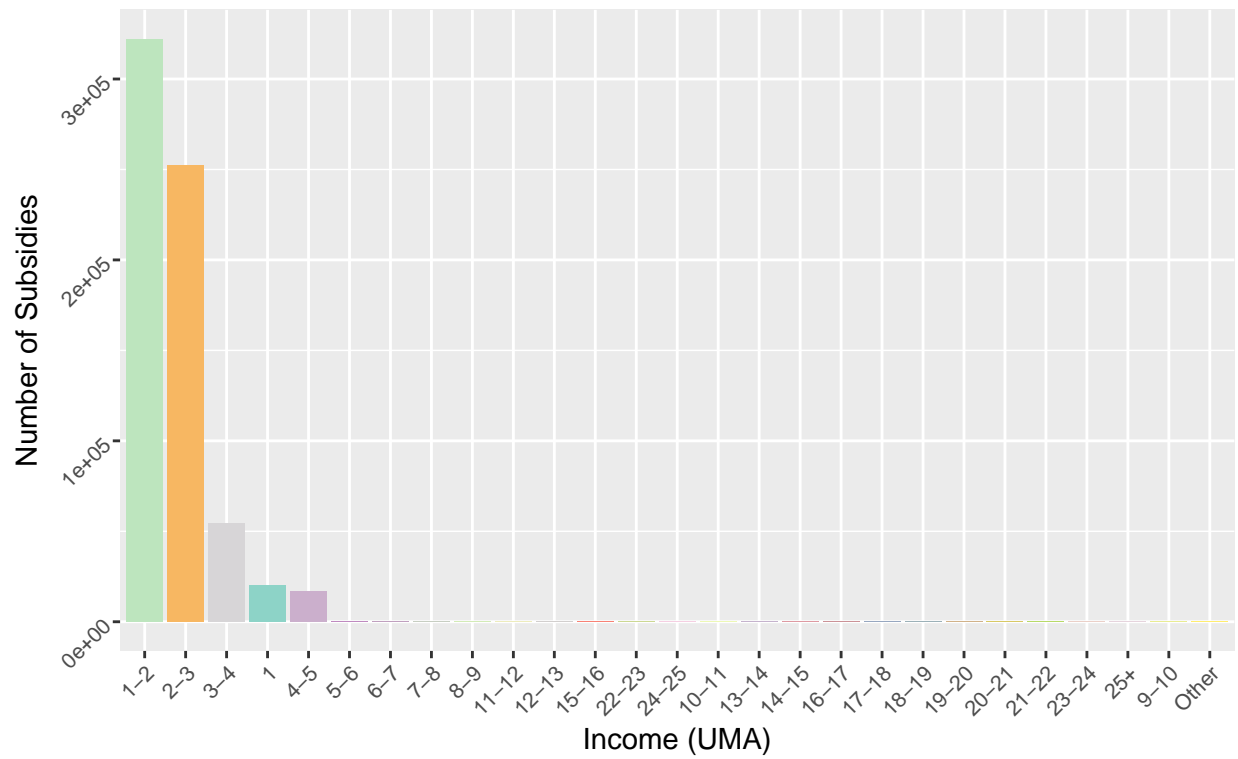
piechart\_NS\_L

Distribution of Subsidies by Credit Line  
2013/01 – 2021/04



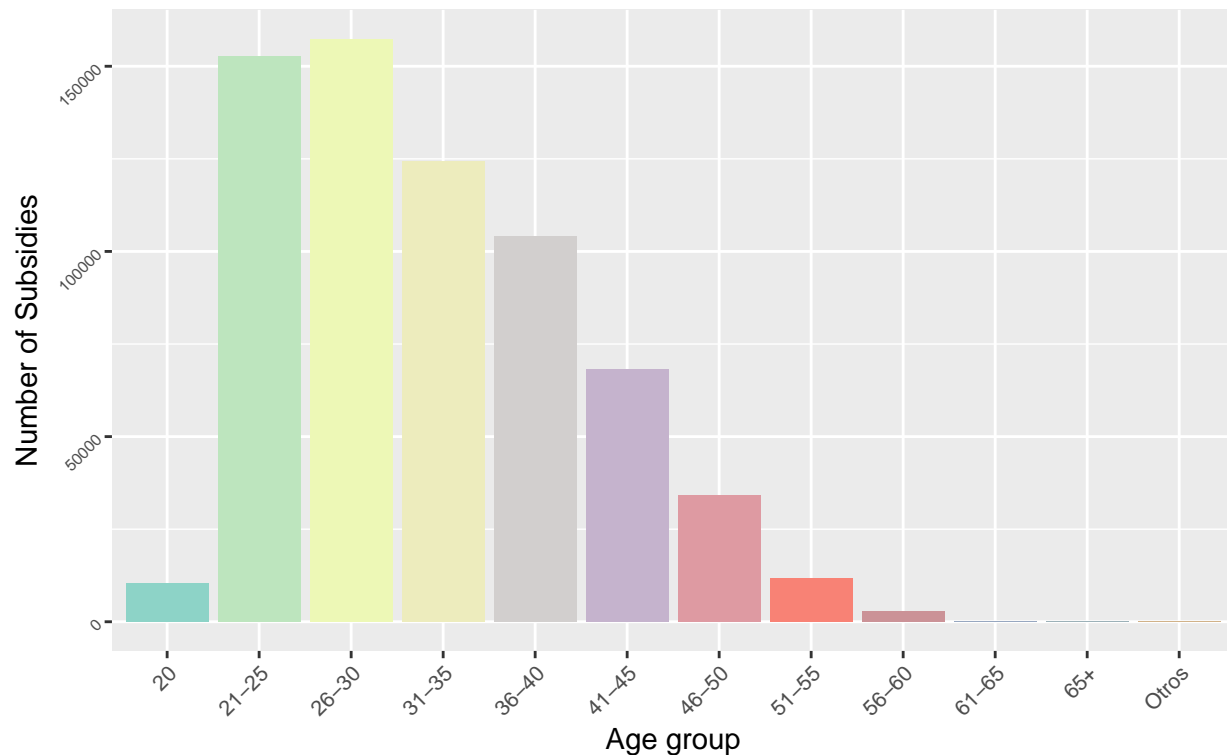
barplot\_NS\_I

Number of Granted Subsidies by Income (UMA)  
2013/01 – 2021/04



barplot\_NS\_Edad

Number of Granted Subsidies by Age  
2013/01 – 2021/04



```
# Por Estado
barplot_MS_Estado<-ggplot(data=MS_Estado)+
  geom_bar(aes(x=reorder(Estado,-MS),y=MS,fill=Estado),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
  labs( x = "State",
        y = "Amount (MXN)",
        title ="Amount of Granted Subsidies by State",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=8,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

# Por Estado como porcentaje
percent_Estado4<-paste(round(100*(MS_Estado$MS/(sum(MS_Estado$MS))), 2), "%", sep="")
MS_Estado$percent<-percent_Estado4

barplot_MS_Estado_percent<-ggplot(data=MS_Estado)+
  geom_bar(aes(x=reorder(Estado,-MS),y=MS,fill=Estado),stat = "identity")+
```

```

geom_text(aes(x=Estado,y=MS,label=percent_Estado4),hjust=-0.2, size=2.5,angle=90)+
scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(32))+
labs( x = "State",
      y = "% / Total Amount",
      title ="Amount of Granted Subsidies by State (%)",
      subtitle = "2013/01 - 2021/04"
    )+
theme(
  axis.text.x=element_text(size=8,angle=45,hjust=1),
  axis.text.y=element_text(size=0,angle=45),
  plot.title = element_text(hjust=0.5),
  plot.subtitle=element_text(hjust=0.5),
  legend.position = "none"
)

# Por Tipo de Producto
# No Aplica: Todos son crédito tradicional

# Por Clasificación de Vivienda
percent_CV4<-paste(round(100*(MS_CV$MS/(sum(MS_CV$MS))), 2), "%", sep="")
MS_CV$percent=percent_CV4

piechart_MS_CV<-ggplot(data=MS_CV, aes(x="", y=MS, fill=ClasificacionVivienda)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_CV4), size=3.5, show.legend = F, position = position_stack(vjust = 1.5)) +
  guides(fill = guide_legend(title = "Dwelling Classification"))+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
  labs(
    y="",
    x="",
    title="Amount of Subsidies by Dwelling Classification",
    subtitle="2013/01 - 2021/04"
  )+
  theme(
    plot.title = element_text(hjust=0.5),
    plot.subtitle = element_text(hjust=0.5),
    axis.text = element_blank(),
    axis.ticks = element_blank(),
    panel.grid = element_blank()
  )

# Por Linea
percent_L4<-paste(round(100*(MS_L$MS/(sum(MS_L$MS))), 2), "%", sep="")
MS_L$percent=percent_L4

piechart_MS_L<-ggplot(data=MS_L, aes(x="", y=MS, fill=Linea)) +
  geom_bar(stat="identity", width=1) +
  coord_polar("y", start=0)+
  geom_label_repel(aes(label = percent_L4), size=3.5, show.legend = F, position = position_stack(vjust = 1.5)) +
  guides(fill = guide_legend(title = "Credit Line"))+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(8))+
  labs(

```

```

y="",
x="",
title="Amount of Subsidies by Credit Line",
subtitle="2013/01 - 2021/04"
)+
theme(
  plot.title = element_text(hjust=0.5),
  plot.subtitle = element_text(hjust=0.5),
  axis.text = element_blank(),
  axis.ticks = element_blank(),
  panel.grid = element_blank()
)

# Por Ingreso
MS_I$UMA<-UMA

barplot_MS_I<-ggplot(data=MS_I)+
  geom_bar(aes(x=reorder(UMA,-MS),y=MS,fill=UMA),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(MS_I)))+
  labs( x = "Income (UMA)",
        y = "Amount (MXN)",
        title = "Amount of Granted Subsidies by Income",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=8,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

# Por Edad
MS_Edad$Edad2<-Edad2

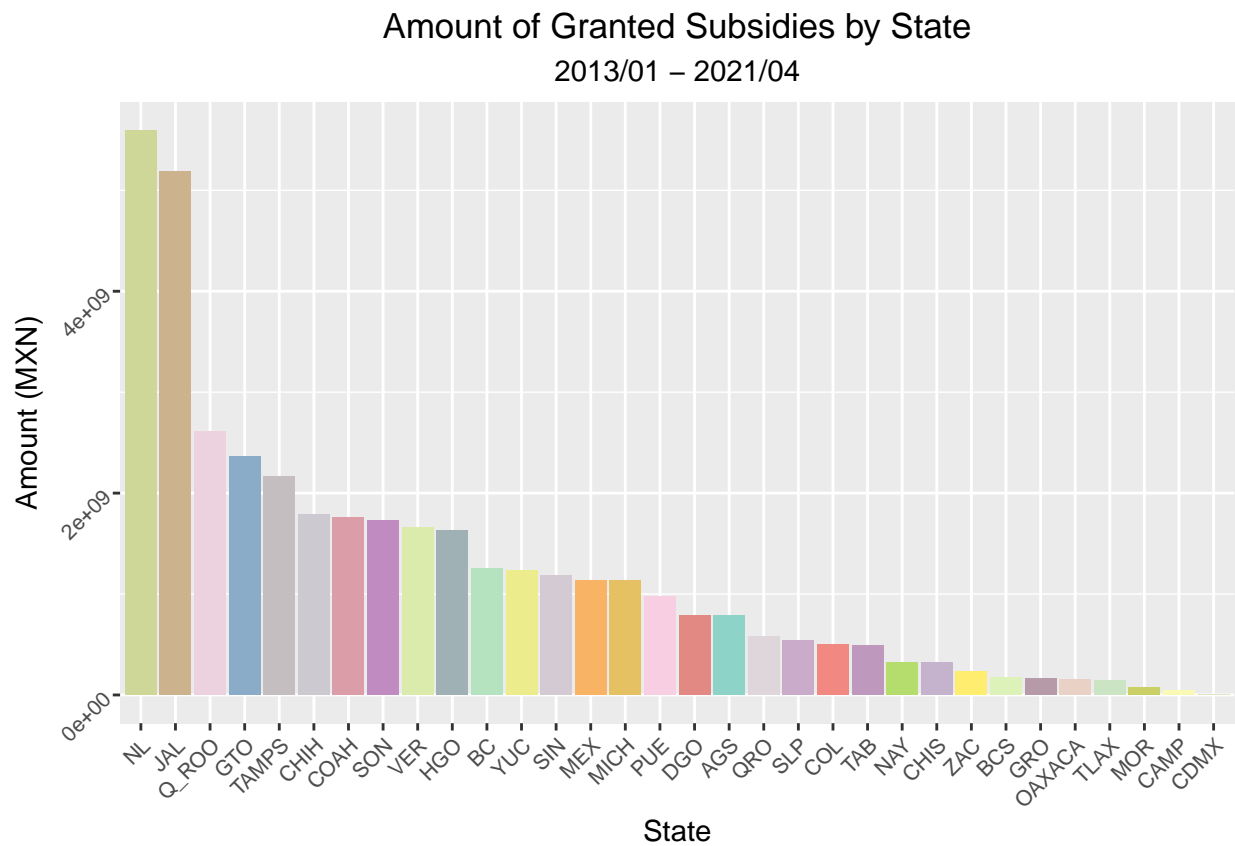
barplot_MS_Edad<-ggplot(data=MS_Edad)+
  geom_bar(aes(x=Edad2,y=MS,fill=Edad2),stat = "identity")+
  scale_fill_manual(values = colorRampPalette(brewer.pal(12, "Set3"))(nrow(MS_I)))+
  labs( x = "Age group",
        y = "Amount (MXN)",
        title = "Amount of Granted Subsidies by Age",
        subtitle = "2013/01 - 2021/04"
  )+
  theme(
    axis.text.x=element_text(size=8,angle=45,hjust=1),
    axis.text.y=element_text(size=6,angle=45),
    plot.title = element_text(hjust=0.5),
    plot.subtitle=element_text(hjust=0.5),
    legend.position = "none"
  )

```

```
barplot_MS_Estado
```



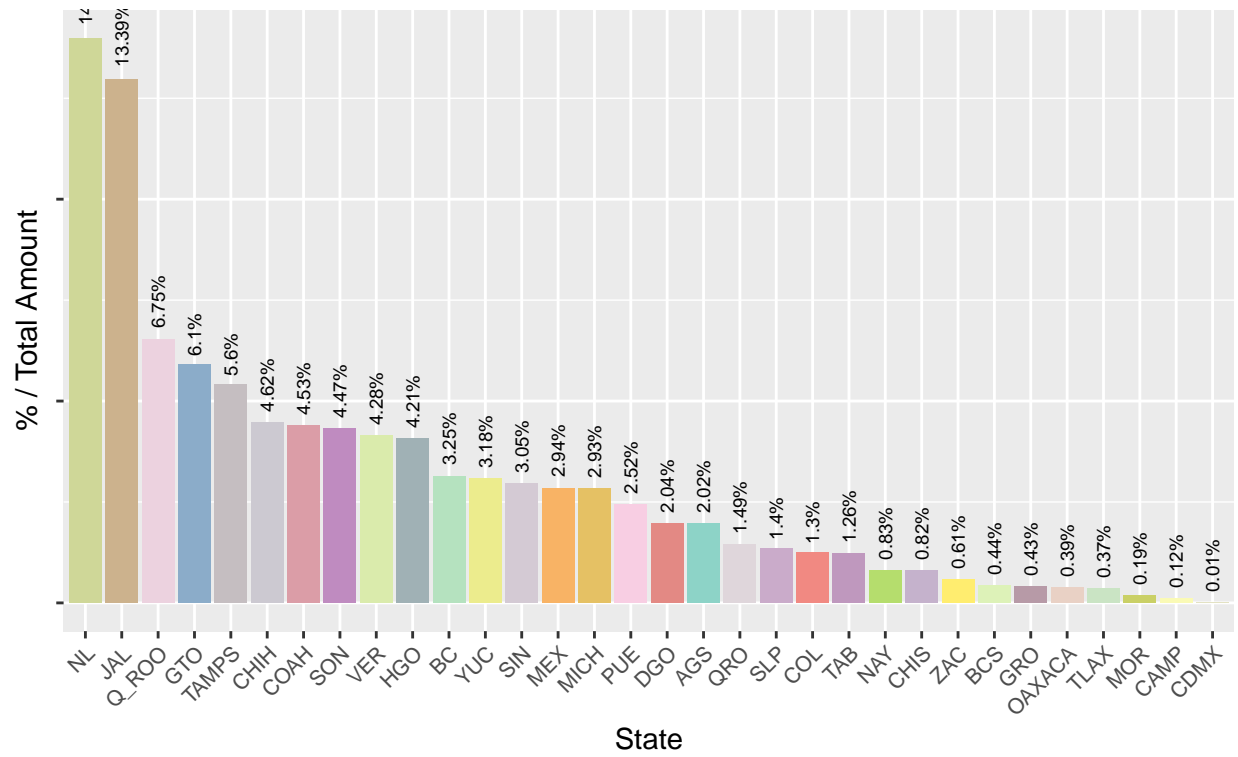
### 1.1.3.2 Amount (\$MXN)



barplot\_MS\_Estado\_percent

## Amount of Granted Subsidies by State (%)

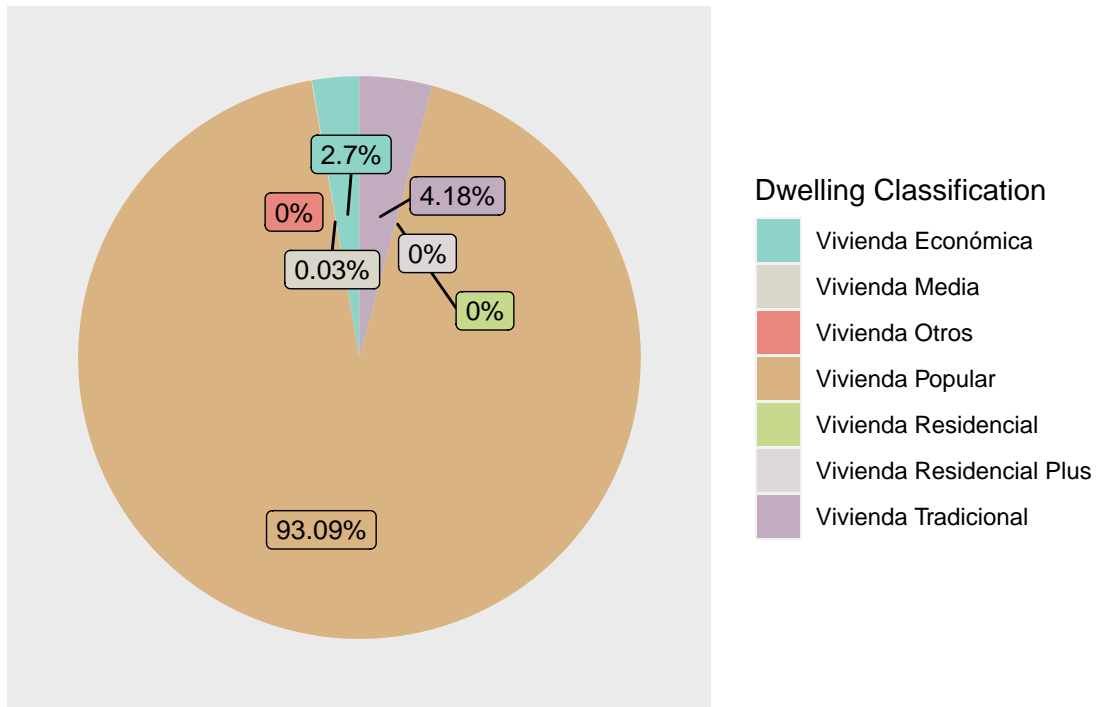
2013/01 – 2021/04



piechart\_MS\_CV

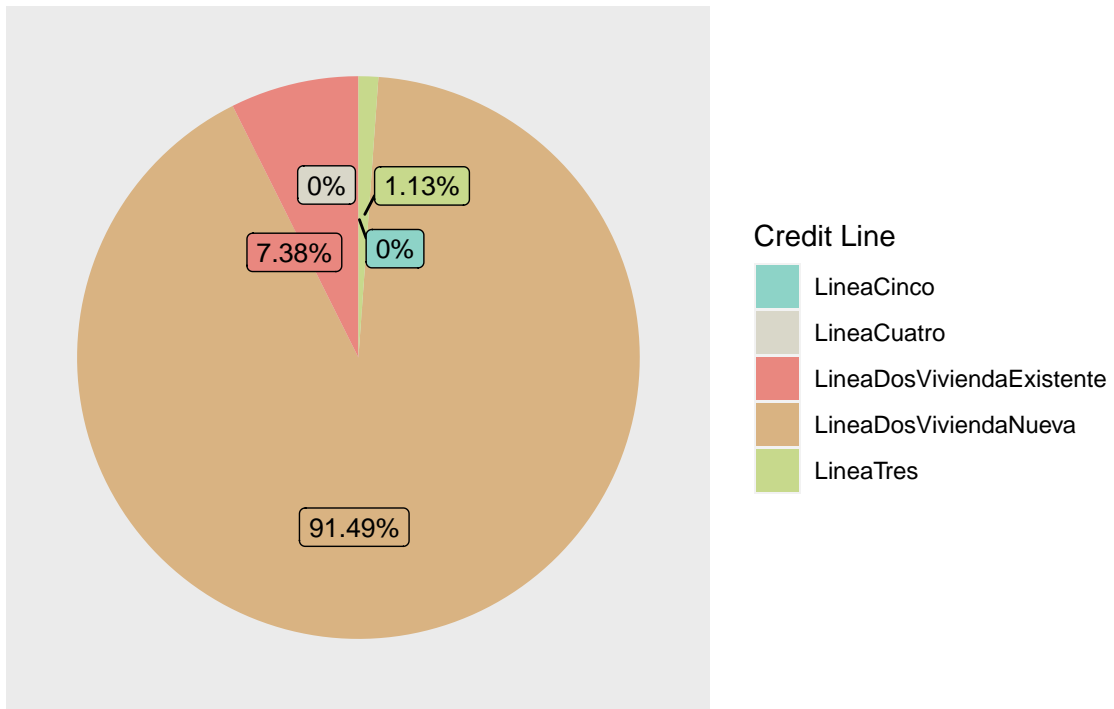
# Amount of Subsidies by Dwelling Classification

2013/01 – 2021/04



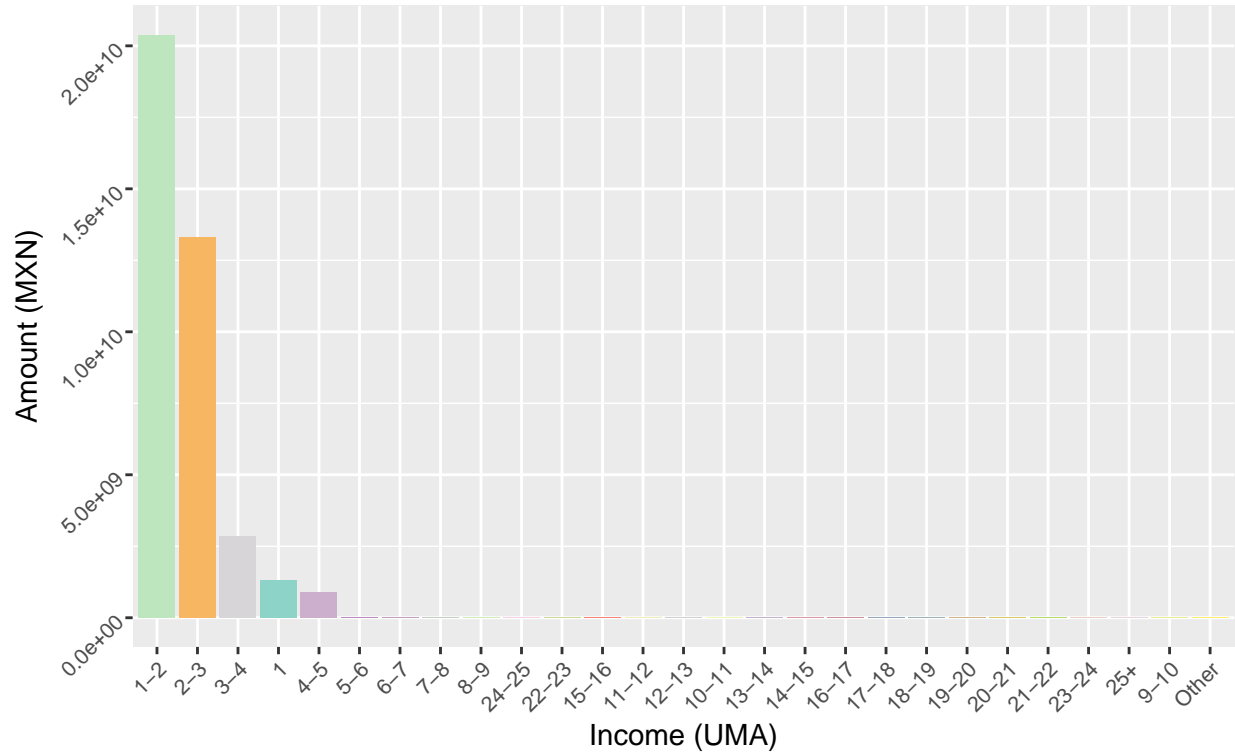
piechart\_MS\_L

Amount of Subsidies by Credit Line  
2013/01 – 2021/04



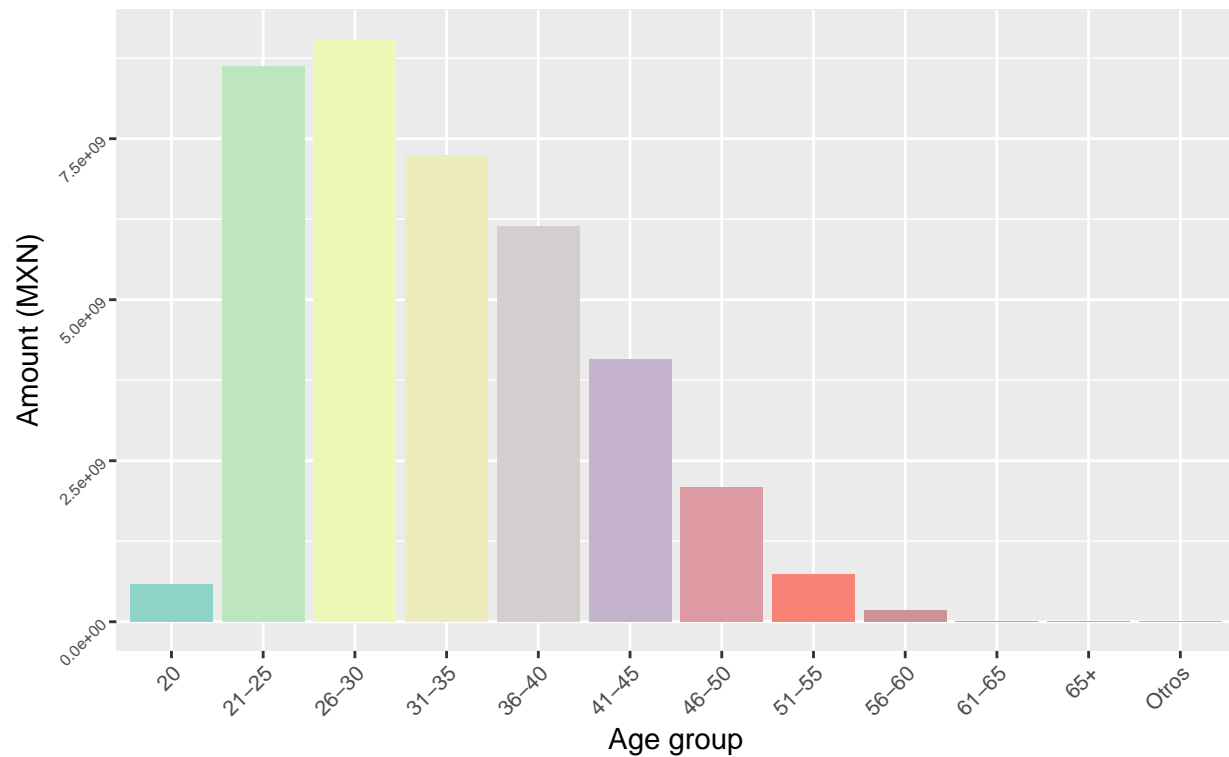
barplot\_MS\_I

Amount of Granted Subsidies by Income  
2013/01 – 2021/04



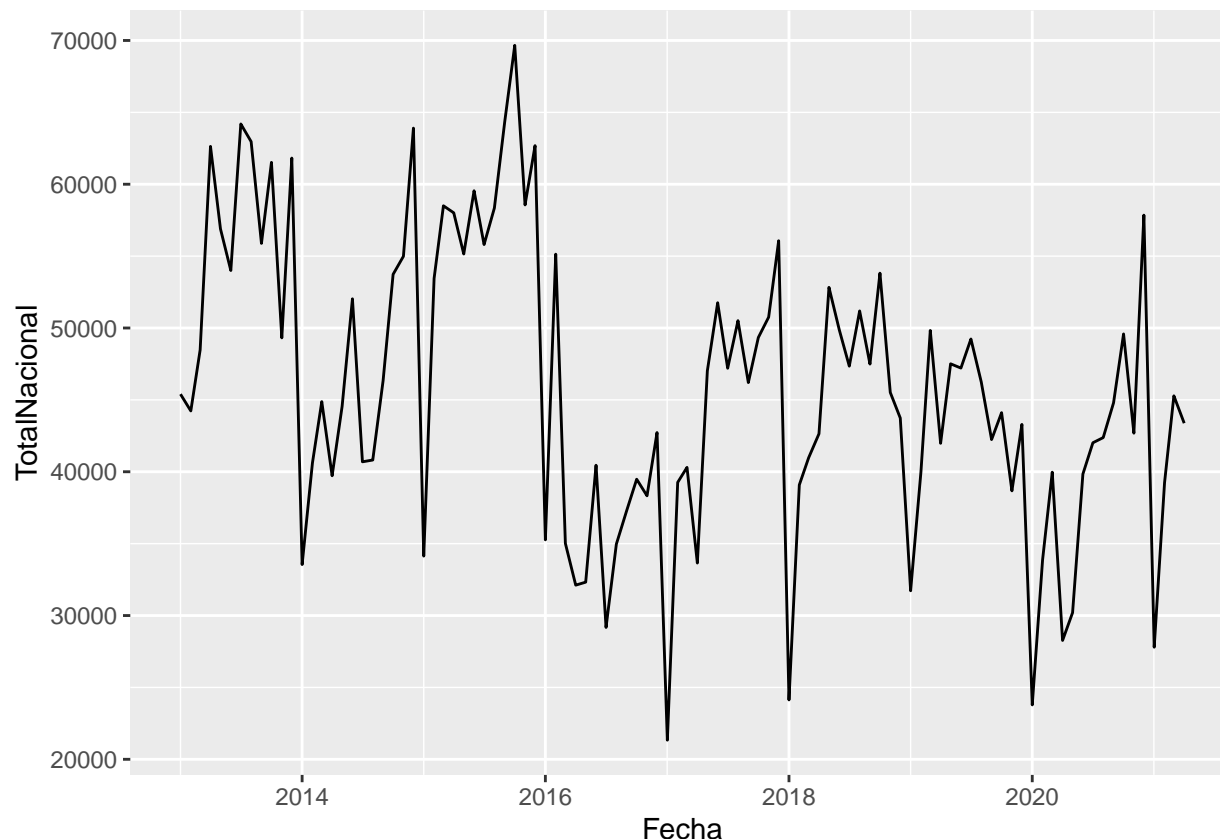
barplot\_MS\_Edad

Amount of Granted Subsidies by Age  
2013/01 – 2021/04



Solo para ver seasonality en el número de créditos otorgados por mes:

```
timeseries_NCTotal<-ggplot(data=NCTotal)+
  geom_line(aes(x=Fecha,y=TotalNacional))
timeseries_NCTotal
```



## 1.2 Data Reported in Sistema de Información Infonavit: Complete Portfolio Analysis

[https://portalmx.infonavit.org.mx/wps/portal/infonavit.web/transparencia/estaditicas/!ut/p/z1/jY\\_\\_BCsIwEEQ\\_aTdNSdZjUmtalKQFQ-tepCcJaPUgfr8iXjwYO7eBNzMMMIzA8\\_RIp-mervN0fvkDq6NyiE1VCh\\_\\_MtsSebIdWd1IZDcMbKAjRWRTeUUNoNnVbr3aycFEAL8njDxlcls8AnK8fgL8nmCXC3u29rUKQtNYfIHfx38jtEuOIqX0C2O](https://portalmx.infonavit.org.mx/wps/portal/infonavit.web/transparencia/estaditicas/!ut/p/z1/jY__BCsIwEEQ_aTdNSdZjUmtalKQFQ-tepCcJaPUgfr8iXjwYO7eBNzMMMIzA8_RIp-mervN0fvkDq6NyiE1VCh__MtsSebIdWd1IZDcMbKAjRWRTeUUNoNnVbr3aycFEAL8njDxlcls8AnK8fgL8nmCXC3u29rUKQtNYfIHfx38jtEuOIqX0C2O)

Leaving behind the database of “otorgamiento de crédito” we now consider the information reported in the section “Estadísticas”, which gives portfolio operating indicators of Infonavit’s **complete** portfolio. The database decomposes Infonavit’s portfolio by: past due portfolio (vencida), extension portfolio (prórroga) and current portfolio (vigente).

Note that, before, we were analyzing credits originated from January 2013 to April 2021, but this new database includes mortgages originated **before** 2013, considering the **complete portfolio** as of 30th of April, 2021.

```
# Complete Portfolio (CP) composition
CP_cuentas<-as.data.frame(read_excel("DATA/CarteraVencida.xlsx", sheet = 1))
CP_saldos<-as.data.frame(read_excel("DATA/CarteraVencida.xlsx", sheet = 2))

# Panel con cuatro gráficas, una gráfica por año: Barras por estado con el total
# de cartera en número de cuentas. Cada barra apilada por vigente + prórroga + vencida
# PENDIENTE

# Panel con cuatro gráficas, una gráfica por año: Barras por estado con el total
```

```
# de cartera en saldo (mdp MXN). Cada barra apilada por vigente + prórroga + vencida
# PENDIENTE

# Gráfica con la sheet 2 del excel, pero sos*
# PENDIENTE
```

## 2 Sample data

Now, we consider our main database. This is the data from where we intend to develop our credit risk model; it describes credits originated from January 2013 to April 2021 *individually*, characterizing each beneficiary by different variables like age, gender, type of dwelling, etc.

In theory, this data base should be exactly the same as the data analyzed at the beginning, reported in “Sistema de Información Infonavit” for 2013/01-2021/04. However, we do not expect this database to be distributed exactly the same as the **complete portfolio** information. We intend to manipulate this sample to best resemble the complete portfolio, so that the credit risk model can more accurately represent reality.

### 2.1 Data Analysis

```
sample<-readRDS(file="DATA/MUESTRA.Rds")
head(sample)
```

```
##      AÑO MES_ACUMULADO CLAVE_ENTIDAD CLAVE_MUNICIPIO      MODALIDAD
## 1 2013              1              1              1 Viviendas nuevas
## 2 2013              1              1              1 Viviendas nuevas
## 3 2013              1              1              1 Viviendas nuevas
## 4 2013              1              1              1 Viviendas nuevas
## 5 2013              1              1              1 Viviendas nuevas
## 6 2013              1              1              5 Viviendas nuevas
##      DESTINO      TIPO GENERO      EDAD      INGRESO
## 1 Vivienda nueva Cofinanciamientos y subsidios Hombre 29 o menos 2.61 a 4.00
## 2 Vivienda nueva Cofinanciamientos y subsidios Hombre 29 o menos 4.01 a 6.00
## 3 Vivienda nueva Cofinanciamientos y subsidios Hombre 29 o menos 6.01 a 9.00
## 4 Vivienda nueva Cofinanciamientos y subsidios Hombre 29 o menos M's de 12
## 5 Vivienda nueva Cofinanciamientos y subsidios Hombre 29 o menos M's de 12
## 6 Vivienda nueva Cofinanciamientos y subsidios Hombre 29 o menos 6.01 a 9.00
##      VALOR_VIVIENDA      MONTO CLAVE
## 1 Tradicional 283223.1 1.1
## 2 Popular 1365780.9 1.1
## 3 Tradicional 803068.0 1.1
## 4 Tradicional 671815.4 1.1
## 5 Media 1650390.9 1.1
## 6 Económica 214819.1 1.5
```

```
tail(sample)
```

```
##      AÑO MES_ACUMULADO CLAVE_ENTIDAD CLAVE_MUNICIPIO      MODALIDAD
## 1397063 2021              1              28              27 Viviendas usadas
## 1397064 2021              1              3              1 Viviendas usadas
```



```
## 1397065 2021      2      14      97 Viviendas usadas
## 1397066 2021      2      28      35 Viviendas usadas
## 1397067 2021      1      30      68 Viviendas usadas
## 1397068 2021      1      14      44 Viviendas usadas
##          DESTINO          TIPO GENERO      EDAD      INGRESO
## 1397063 Vivienda usada Credito individual Hombre 29 o menos 2.6 o menos
## 1397064 Vivienda usada Credito individual Hombre 29 o menos 2.6 o menos
## 1397065 Vivienda usada Credito individual  Mujer 29 o menos 2.6 o menos
## 1397066 Vivienda usada Credito individual  Mujer 29 o menos 2.6 o menos
## 1397067 Vivienda usada Credito individual  Mujer 29 o menos 2.6 o menos
## 1397068 Vivienda usada Credito individual  Mujer 29 o menos 2.6 o menos
##          VALOR_VIVIENDA      MONTO CLAVE
## 1397063      EconŰmica 312690.0 28.27
## 1397064      EconŰmica 316308.3   3.1
## 1397065      EconŰmica 319551.4 14.97
## 1397066      EconŰmica 322922.0 28.35
## 1397067      EconŰmica 275690.8 30.68
## 1397068      EconŰmica 300287.6 14.44
```

```
str(sample)
```

```
## 'data.frame':  1397068 obs. of  13 variables:
## $ AŰO      : Factor w/ 9 levels "2013","2014",...: 1 1 1 1 1 1 1 1 1 ...
## $ MES_ACUMULADO : Factor w/ 12 levels "1","2","3","4",...: 1 1 1 1 1 1 1 1 1 ...
## $ CLAVE_ENTIDAD : Factor w/ 32 levels "1","2","3","4",...: 1 1 1 1 1 1 1 1 1 ...
## $ CLAVE_MUNICIPIO: Factor w/ 316 levels "0","1","2","3",...: 2 2 2 2 2 6 7 12 12 12 ...
## $ MODALIDAD      : Factor w/ 4 levels "Mejoramientos",...: 3 3 3 3 3 3 3 3 3 ...
## $ DESTINO        : Factor w/ 6 levels "AutoproducciŰn",...: 5 5 5 5 5 5 5 5 5 ...
## $ TIPO           : Factor w/ 2 levels "Cofinanciamientos y subsidios",...: 1 1 1 1 1 1 1 1 1 ...
## $ GENERO         : Factor w/ 3 levels "Hombre","Mujer",...: 1 1 1 1 1 1 1 1 1 ...
## $ EDAD           : Factor w/ 4 levels "29 o menos","30 a 59",...: 1 1 1 1 1 1 1 1 1 ...
## $ INGRESO        : Factor w/ 7 levels "2.6 o menos",...: 2 3 4 6 6 4 5 3 3 5 ...
## $ VALOR_VIVIENDA : Factor w/ 7 levels "EconŰmica","Media",...: 7 4 7 7 2 1 7 4 7 7 ...
## $ MONTO          : num  283223 1365781 803068 671815 1650391 ...
## $ CLAVE          : Factor w/ 1911 levels "1.0","1.1","1.10",...: 2 2 2 2 2 8 9 4 4 4 ...
```

```
summary(sample)
```

```
##          AŰO      MES_ACUMULADO      CLAVE_ENTIDAD      CLAVE_MUNICIPIO
## 2019      :188218      12      :133591      15      :149449      6      : 47494
## 2018      :186917      10      :125325      19      :115360      5      : 46046
## 2015      :186073       8      :119602      14      : 99518      2      : 44994
## 2017      :179491       2      :119336      30      : 81642      1      : 41861
## 2020      :179336       6      :118882       5      : 74938      4      : 37877
## 2016      :156016       9      :118240      11      : 64865      18      : 36384
## (Other):321017 (Other):662092 (Other):811296 (Other):1142412
##          MODALIDAD          DESTINO
## Mejoramientos :361602 AutoproducciŰn      : 5
## Otros programas : 9766 Con disponibilidad de terreno: 16626
## Viviendas nuevas:496191 Mejoramientos      :361602
## Viviendas usadas:529509 Pago de pasivos      : 9766
##          Vivienda nueva      :479560
##          Vivienda usada      :529509
```

```
##
##                                TIPO                                GENERO
## Cofinanciamientos y subsidios:500133  Hombre                :858539
## Credito individual                   :896935  Mujer                :531362
##                                     No disponible: 7167
##
##
##
##
##                                EDAD                                INGRESO                                VALOR_VIVIENDA
## 29 o menos      :417938  2.6 o menos      :318690  Econ mica      : 65335
## 30 a 59         :945999  2.61 a 4.00      :270913  Media          :197201
## 60 o m s        : 12652  4.01 a 6.00      :244657  No disponible  :324806
## No disponible: 20479  6.01 a 9.00      :222882  Popular        :376124
##                                     9.01 a 12.00 :134704  Residencial    : 48282
##                                     M s de 12    :205114  Residencial plus: 9013
##                                     No disponible: 108  Tradicional     :376307
##
## MONTO                                CLAVE
## Min.      : -424633  14.120 : 16668
## 1st Qu.: 58243  2.4 : 16586
## Median : 352699  11.20 : 16072
## Mean : 763071  8.19 : 15985
## 3rd Qu.: 740000  19.6 : 15464
## Max. :180487760  22.14 : 15023
##                                     (Other):1301270
```

```
# GR FICAS DE GABRIEL* Pegar su code*
```

## 2.2 Adjust Sample to Match Population's Characteristics

```
# Berny
```

## 2.3 Assign Variable Status

```
# Luly
```

## **3 Credit Risk Model**

### **3.1 Logistic Regression**

### **3.2 Evaluation**

### **3.3 Regional Analysis & Clusters**

## **4 Building a Cross-Subsidy Scheme**

### **4.1 Assigning an Interest Rate**

## **5 Comparative Statics & Tests**