```
pip install dowhy pandas matplotlib
```

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Requirement already satisfied: pandas in /usr/local/lib/python3.11/dist-packag
Requirement already satisfied: matplotlib in /usr/local/lib/python3.11/dist-pa
Requirement already satisfied: causal-learn>=0.1.3.0 in /usr/local/lib/python3
Requirement already satisfied: cvxpy>=1.2.2 in /usr/local/lib/python3.11/dist-
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Requirement already satisfied: joblib>=1.1.0 in /usr/local/lib/python3.11/dist
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Requirement already satisfied: pillow>=8 in /usr/local/lib/python3.11/dist-pac
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Requirement already satisfied: llvmlite<0.44,>=0.43.0dev0 in /usr/local/lib/py
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-pack
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Requirement already satisfied: setuptools in /usr/local/lib/python3.11/dist-pa
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/di
```

```
import pandas as pd
import dowhy
from dowhy import CausalModel
import matplotlib.pyplot as plt
```

```
# Create DataFrame from your data
data = {
    'County': ['Pictou', 'Inverness', 'Cape Breton', 'Yarmouth', 'Colchester', 'L
               'Guysborough', 'Annapolis', 'Queens', 'Kings', 'Digby', 'Cumberlan
    'Accessible_Homes': [16, 6, 29, 5, 6, 8, 6, 7, 1, 4, 4, 5, 6, 11, 1, 6, 1],
    'Total_Homes': [36, 16, 80, 16, 17, 13, 41, 14, 7, 9, 5, 25, 12, 28, 4, 8, 6]
    'Percent_Accessible': [44, 38, 36, 31, 35, 62, 15, 50, 14, 44, 80, 20, 50, 39
    'Avg_Distance_km': [12.3, 26.5, 10.1, 30.2, 17.5, 15.6, 8.2, 13.1, 35.4, 22.6
}

df = pd.DataFrame(data)

# Define causal model
model = CausalModel(
    data=df,
    treatment="Avg_Distance_km",                # Treatment (cause)
    outcome="Percent_Accessible",               # Outcome (effect)
    common_causes=["Total_Homes"]               # Control variable
)

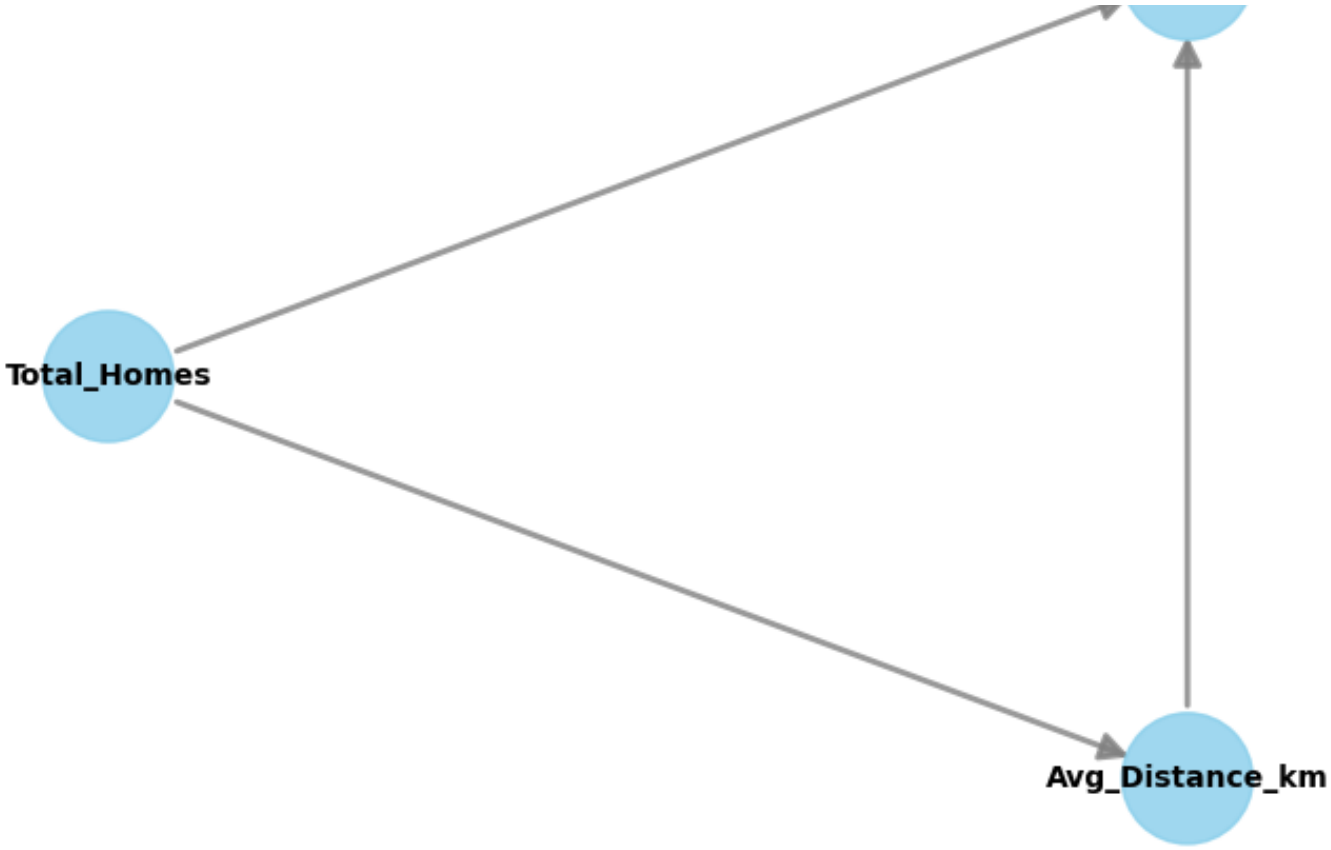
# View causal graph
model.view_model()
plt.show()

# Identify effect using backdoor method
identified_estimand = model.identify_effect(proceed_when_unidentifiable=True)
print("Identified Estimand:", identified_estimand)

# Estimate causal effect
estimate = model.estimate_effect(identified_estimand,
                                 method_name="backdoor.linear_regression")
print("Causal Estimate:", estimate.value)

# Refute estimate to test robustness
refutation = model.refute_estimate(identified_estimand, estimate,
                                   method_name="placebo_treatment_refuter")
print("Refutation Result:", refutation)
```

```
WARNING:dowhy.causal_model:Causal Graph not provided. DoWhy will construct a g
WARNING:dowhy.causal_model:There are an additional 2 variables in the dataset
```




```
Identified Estimand: Estimand type: EstimandType.NONPARAMETRIC_ATE

### Estimand : 1
Estimand name: backdoor
Estimand expression:
        d
──────────────────(E[Percent_Accessible|Total_Homes])
d[Avg_Distance_km]
Estimand assumption 1, Unconfoundedness: If U→{Avg_Distance_km} and U→Percent_

### Estimand : 2
Estimand name: iv
No such variable(s) found!

### Estimand : 3
Estimand name: frontdoor
No such variable(s) found!

Causal Estimate: -0.8005117829925013
/usr/local/lib/python3.11/dist-packages/scipy/stats/_axis_nan_policy.py:418: U
  return hypotest_fun_in(*args, **kwds)
/usr/local/lib/python3.11/dist-packages/dowhy/causal_estimators/regression_est
  intercept_parameter = self.model.params[0]
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refutation = model.refute_estimate(identified_estimand, estimate,
                                   method_name="placebo_treatment_refuter")
print("Refutation Result:", refutation)
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